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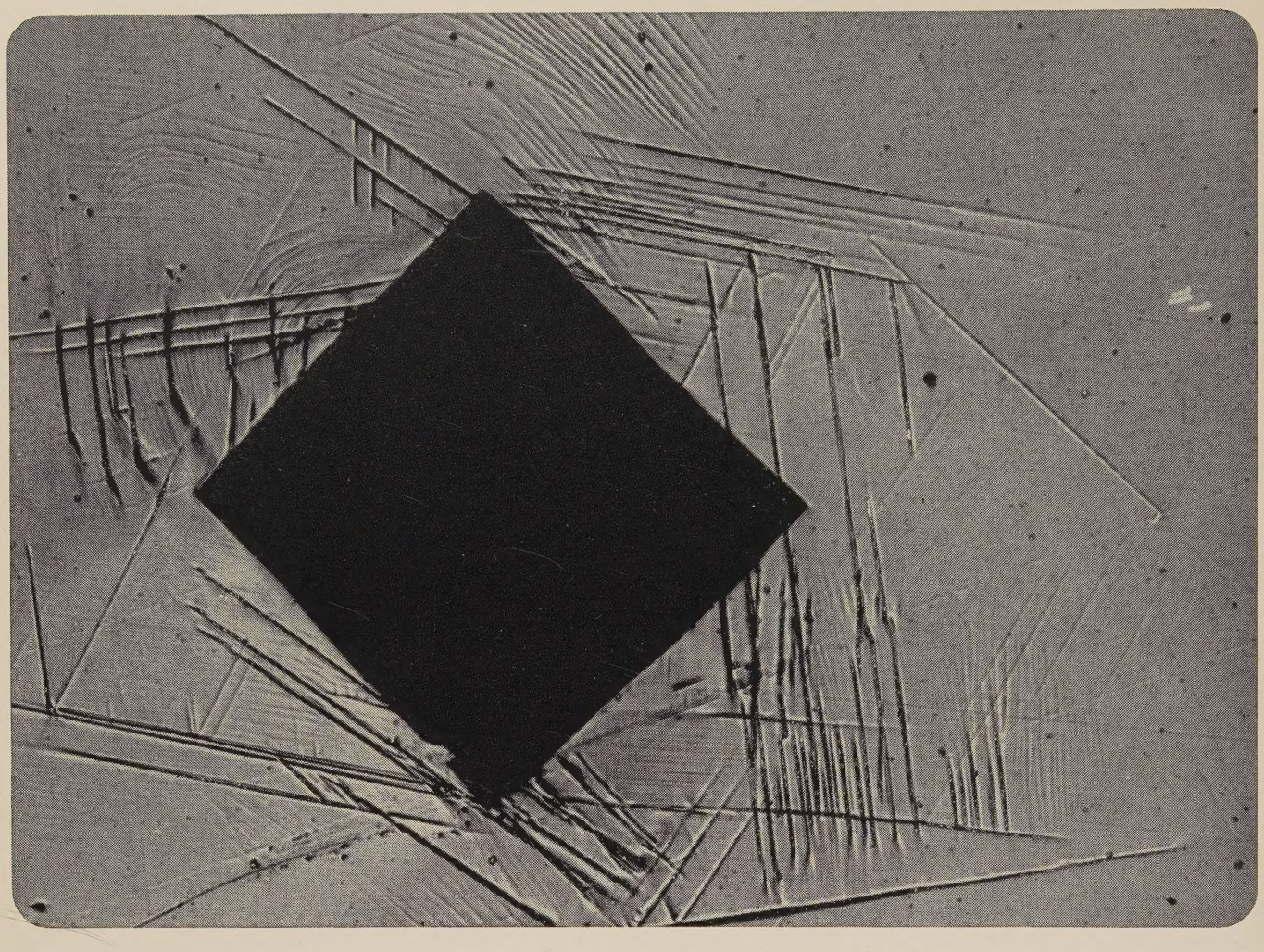
TECHNOGRAPH

JANUARY 25



Did you ever hear atoms move?

The physicist positions a single crystal of age-hardened steel under the sharp diamond penetrator. He touches a pedal, and the pyramidal tip of the diamond squeezes into the polished surface of the steel.

The instant that it touches, things begin to happen inside the crystal. Atoms begin to slip and slide, in layers. Some layers abruptly wrinkle and corrugate. If you listen hard when this happens, you hear a faint, sharp, "click." This is the sound of atoms suddenly shifting within the crystal.

You can see the action, too—or, rather, the results of it. The photomicrograph above shows the characteristic ridges and ripples. The black diamond in the center is the depression made by the penetrator.

By studying these patterns, and correlating the information with other data, scientists at U. S. Steel are trying to learn what happens atomically when a steel is bent, flexed or broken. Thus, they try to develop new and better steels for an exacting and ever-growing steel market.

Research is only one area in which we need high-level scientific personnel. Partly, this is due to the fact that men progress so rapidly at United States Steel. Remember these figures: among the 20,000 members of our management team, 99% attained their position through advancement within the corporation. If you want to take advantage of odds like this, write for our booklet, "Paths of Opportunity."
Write to United States Steel, Personnel Division, Room 5680, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS

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THE ILLINOIS TECHNOGRAPH

Volume 73, Number 4 **January, 1958**

ARTICLES:

Future of the Highway ---- Phil Philhower 18
The Automotive Industry Rolls On ---- 22
Atomic Events ---- 24
New Developments in Jet Aircraft ---- 25
High Temperature Photos ---- 27
Architecture at the U. of I. ---- Lowell Burgin 53
Patent Laws ---- Raymond Norton 55
Tiniest Tugboat ---- 64

FEATURES:

Editorial ---- 17
The Theory Jack Built ---- 28
L.A.R. at Night ---- 29
Brainteasers ---- edited by Donna Zverow 33
Crated ---- a short story by Ruth Kahn 34
Technocutie ---- by Dave Moore 45
Engineering Madness ---- 58
Begged, Borrowed, and . . . ---- edited by Donna Zverow 80

Cover . . .

In keeping with major articles on American highways and the automotive industry, Donna Toika designed this abstraction of a highway scene.

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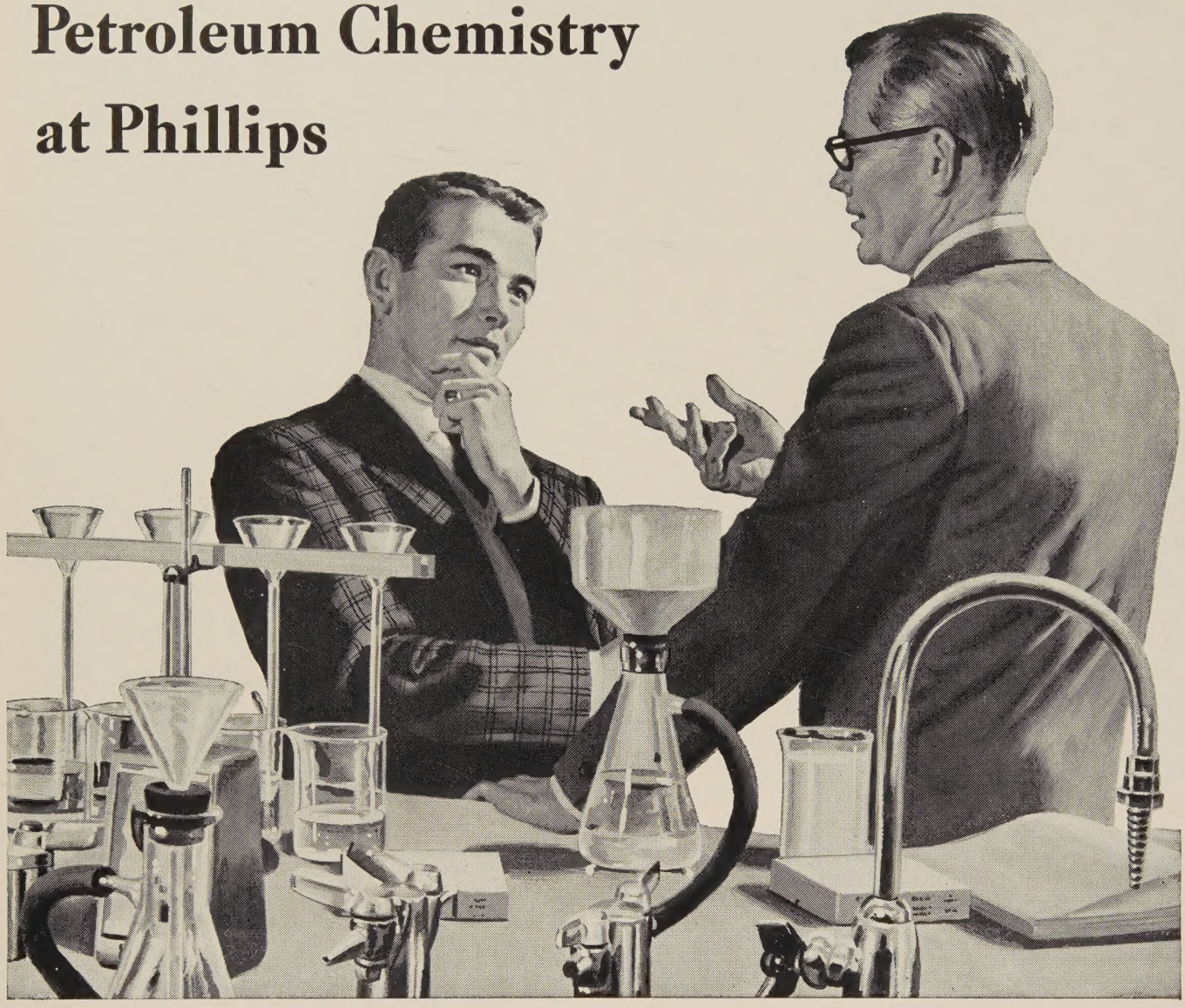
Picture Yourself in Petroleum Chemistry at Phillips



What do you see? Are you helping design a fractionation unit? Developing a new rocket propellent? Perhaps you're constructing a new polyethylene reactor . . . or working on an improved octane number system.

Petroleum chemistry is important at Phillips . . . but so are gasoline refining, uranium processing, pipe line design, oil geology and exploration, research and the dozens of other activities which are essential to Phillips broad and diversified operations. The wide selection of possibilities available in these various specialties enables you to choose a career that matches your education and interests.

During the past ten years Phillips has expanded tremendously. Many important new developments are still in the making. So when the Phillips representative comes to this campus, be sure to arrange for an interview. Meanwhile, write to our Technical Manpower Division for your copy of our new brochure, "Career With A Future".

Phillips 66

D. R. McKeithan, Director
Technical Manpower Division
PHILLIPS PETROLEUM COMPANY
Bartlesville, Oklahoma

Investment Policy —

The word is out. The news is being batted back and forth during coffee sessions: engineers are in demand. It's a familiar theme, and true enough, a situation that Sputnik only served to intensify. The jobs are there, the salaries are high, and still there aren't enough trained personnel. If you believe some stories, you'd figure that they're buying anyone with a diploma and a warm body.

It's easy to grow lax in such a situation, counting on demand to replace the need for ability and a good academic record. A good record in technical courses is necessary, certainly, for we are hardly fair to ourselves or our employers if we have not mastered our required subjects.

Let's not forget, however, that there's more in the picture than lab grades. Business is searching as never before for something in an engineer other than the ability to play tricks with a slide rule. Finding people with something other than technical knowledge is becoming a big job for the industries—because they aren't finding enough people with that blend of talent.

Sales, application, and management in this technological society of ours now requires not only general, but technical knowledge as well. That's understandable in a machine age. People, though, aren't machines, and thermodynamics won't help when handling the human factor.

Sure, technical courses are time consuming, but if you've any hope of cashing in on the demand for engineers with a broad background, remember that now you're getting that background.

Or are you? There are ample rewards, both personal and financial, for you if you have that liberal knowledge. Now, at the beginning of a new semester, is the time to start acquiring it. Take a few South-Campus courses now, and begin that investment in your own future.

DEL

A complete network of superhighways will span the United States by 1975

Future of the Highway

The road ahead is going to be smooth, safe and swift.

The nation has started building the greatest network of roads ever conceived by man. By 1971, there will exist some 50 billion dollars worth of roads, most of which are not on your road maps today.

This is the biggest building project in history—60 times greater than the Panama Canal. It also is the first time in American history that our nation has promise of completing a planned system of highways in a given number of years.

When finished, the project will affect directly more Americans than anything our nation ever has built.

But if blueprints are going to become highways, you have a part to play. For the law that launched this mammoth project has provided that the voice of the public shall be heard as the program unfolds. Rarely has the individual been given such an important role in a public works project.

This has been written to help you act wisely. In nontechnical terms, it explains provisions of the bill, details of construction, the history of road building in the United States, and the results you may expect.

Only our nation could have the vision for such a vast program. For only America has the need for it . . . and the resources to see it through to completion. And only America . . . unawed by bigness . . . could start such a program without a doubt of its success.

With the help of informed citizens like yourself, it will succeed.

If you own a car . . . if you take an hour driving 12 miles to work . . . if you have spent an otherwise pleasant summer Sunday creeping through one bottleneck after another . . . if you have had a friend or relative killed or maimed in a traffic accident . . . you are one of the originators of this program.

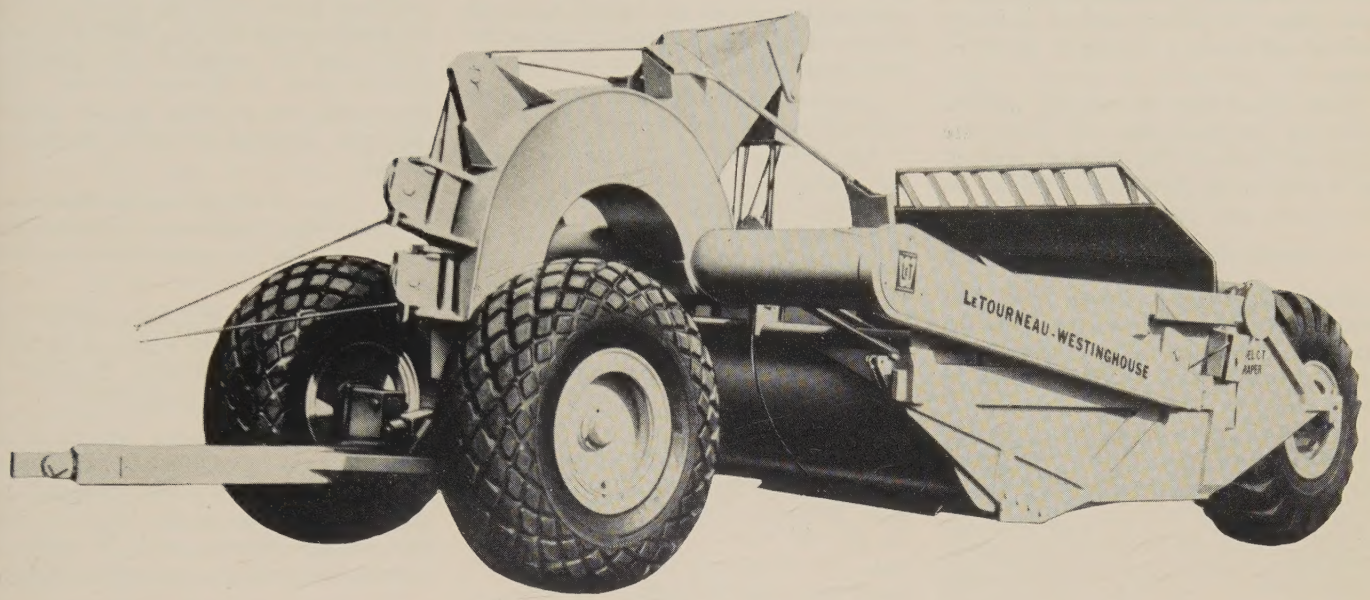
Each year it had become more obvious that the United States—the most mobile nation on earth—was being strangled by poor roads. And the outlook was frightening. In 1956, there were 65 million vehicles on the road. By 1975, this figure is expected to be well over 90 million. Unless something was done—and done immediately—you soon would be able to move just as quickly by horse and buggy—as, indeed, you can in some of our large cities today.

So it was the weight of public opinion, more than anything else, that was responsible for starting this gigantic program on June 29, 1956.

On that day the President signed into law the "Federal-Aid Highway Act of 1956," the deceptively undramatic title of the legislation which signaled the beginning of the greatest building project in history.

Although this magnificent system of modern highways is authorized by a Federal act and will be paid for mainly by Federal money, the building will be the job of *the* 48 *individual states.*

In the United States, road building is traditionally the job of the states. There are no Federal highways in the United States, except those roads which



by Phil Philhower

are on Federal land. The U. S. Route signs you see along highways are merely for the convenience of travelers. Such roads were built as individual state roads and then linked together with a common U. S. Route number.

The new roads will be a state responsibility except for those in national forests and parks. The states, working together, helped plan the routes. The states will make the surveys, plans and specifications. The states will let the contracts. The states will supervise construction and will be responsible for maintenance.

In all these functions, the states will have the expert help and guidance of the U. S. Bureau of Public Roads, the Federal agency which will coordinate this gigantic program.

Building of roads in this country is a state function. But in 1916 the Federal government began to contribute money to states to help them build roads.

At first, this money could be spent on any road used to carry mail. But in 1921 use was restricted to a system of roads now known as the—

Primary System. This is the general network of main highways selected by the states for improvement with Federal assistance. Between the two World Wars, much of this vast system was built, largely as two-lane highways. The states were required to match the amount of money which they received from the Federal government. And the money was granted to the states on the basis of their area, population and their mileage of rural mail routes.

In 1944, the Federal government provided substantial amounts of Federal money for two other types of roads—

Secondary System. This is a system of farm-to-market rural roads designated by the states and coordinated by the Bureau of Public Roads.

Urban Roads. For the first time Federal money was provided specifically for extension of Federal-aid roads into urban areas.

In 1944, Congress also asked the States and the Bureau of Public Roads to map out still another system—

The Interstate Highway System. This would be a super-network of the most important 40,000 miles of the Primary System (now increased to 41,000 miles). It would connect more than 90% of all cities with a population of 50,000 or more (209 cities in all), 42 of the 48 state capitals, and all 48 states. Although this system amounts to only 1.2 per cent of the total rural mileage in the nation it is expected to carry about 20 per cent of the traffic on all streets and highways. These figures give some idea of the importance of the Interstate System to our economy as well as our national defense.

Today, there are some 755,278 miles of roads eligible for Federal grants. They are the Federal-aid roads of the United States.

In the next 13 to 15 years, the Federal government will spend about 27.3 billion dollars building Federal-aid roads. And it probably will make additional appropriations of 8.7 billion dollars in that time. The total thus will be near 36 billion dollars—five times

more than it spent during the preceding 40 years.

At the same time, the states will spend nearly 13 billion. Including expenditures in Federal lands, the states and the Federal government will spend more than 50 billion dollars building Federal-aid roads in the next 13 to 15 years.

More than half the money will be spent on 41,000 miles of Interstate Highway System. The Federal government will spend 24.8 billion dollars on this system and the states—required to put up only 10 per cent of the cost—will contribute 2.6 billion. Therefore a total of 27.4 billion dollars will be spent on the Interstate System.

Most of the remainder will build other parts of the Primary System, Secondary System and city roads. As usual, states will match the Federal money for this construction.

Improvements will also be made in national forests and national parks.

There is a new basis for dividing the money for the construction of the Interstate Highway System. For the first three years, the money will be apportioned two-thirds on population, one sixth on area and one sixth on the mileage of rural post roads. For the final 10 years, the money will be apportioned to states by the estimated cost of completing the Interstate System in each state.

Money for the construction of Federal-aid highways other than the Interstate Highway System will be divided on the old basis, one third on population, one third on area, one third on rural post road mileage.

Here's how much money it is estimated each state will receive from the federal government for Federal-aid highway construction during the next 13 years.

Alabama	$ 730,800,000
Arizona	424,200,000
Arkansas	529,000,000
California	2,019,600,000
Colorado	518,300,000
Connecticut	342,500,000
Delaware	202,200,000
Florida	608,400,000
Georgia	838,700,000
Idaho	364,300,000
Illinois	1,668,500,000
Indiana	872,100,000
Iowa	751,300,000
Kansas	683,300,000
Kentucky	666,900,000
Louisiana	588,500,000
Maine	284,400,000
Maryland	418,700,000
Massachusetts	735,700,000
Michigan	1,277,600,000
Minnesota	829,600,000
Mississippi	574,000,000
Missouri	986,400,000
Montana	539,000,000
Nebraska	544,100,000
Nevada	371,100,000
New Hampshire	204,800,000
New Jersey	753,900,000
New Mexico	450,700,000
New York	2,469,500,000
North Carolina	903,500,000
North Dakota	406,900,000
Ohio	1,509,300,000
Oklahoma	661,200,000
Oregon	507,900,000
Pennsylvania	1,865,800,000
Rhode Island	216,400,000
South Carolina	476,900,000
South Dakota	427,700,000
Tennessee	766,800,000
Texas	2,112,500,000
Utah	351,900,000
Vermont	201,200,000
Virginia	718,400,000
Washington	582,000,000
West Virginia	418,200,000
Wisconsin	822,600,000
Wyoming	369,900,000
District of Columbia	220,900,000

Interstate System

24.8 billion—This figure refers to the amount of *Federal* money authorized through 1969 to build the *Interstate System only*. It represents 90% of the cost.

27.4 billion—This is the total of both *Federal and State* money to be spent on the *Interstate System*. States contribute 10% of the cost.

Other Federal-Aid Roads

2.5 billion—This is the amount of *Federal* money authorized for all *other Federal-aid roads* for 1957 to 1959. States will match this total.

Totals for All Federal-Aid Roads

$27.3 billion—This is the total *Federal* money authorized for the Interstate System through 1969—and for all other Federal-aid roads through 1959.

$32.5 billion—This is the total *Federal and State* money to be spent on the Interstate System through 1969—and for all other Federal-aid roads through 1959.

Projected Totals

$8.7 billion—It is anticipated that Congress will appropriate at least this amount for Federal-aid roads (other than the Interstate System) from 1959 to 1969. States will match this money.

$36 billion—If the above figure is appropriated, this will be the total *Federal* appropriation for both the *Interstate System and other Federal-aid roads* from 1957 to 1969.

$50 billion—If the $8.7 billion is appropriated, this is the *grand total of state and Federal money to be spent* on *all* Federal-aid roads through 1969.

Other Figures

$101 billion—In 1954, states estimated it would cost this much to bring *all* roads and streets to "tolerable standards" and to complete the Interstate System—over a 10-year period. This figure *has no meaning* in the present program, although you often see it mentioned.

13 years—Federal authorization for building the Interstate System was made for the 13 years between 1957 and 1969.

15 years—This is the amount of time it is expected will be required to build the Interstate Highway System. It should be completed about 1971.

Speed limits, of course, are up to the state. But, to provide a margin of safety, the roads are being designed for speeds of 70 miles on flat land, 60 miles for rolling country, and 50 miles in mountainous terrain and urban areas.

The law forbids service stations and other commercial businesses on the right-of-way.

But don't worry, there will be plenty of places to turn off for gas, food, lodging and other services.

A system of signs, which will inform you when you are approaching areas where such services are available, is being worked out. In many cases, you will simply be able to turn off into a nearby town or city. Out in rural areas, commercial services probably will be grouped around access points in the manner that the businesses themselves elect.

One of the main reasons the Interstate System is being built in this manner is to save your life. Controlled access roads are much safer than roads with intersections at grade and driveways. *The accident rate on controlled access roads is one-third of that on other roads. It is estimated that the Interstate System will save 3,500 lives a year!*

In addition, controlled access protects your tax money. New roads always attract new commercial businesses and homes. More driveways and cross roads are added. Soon the road becomes such a bottleneck that it cannot handle the traffic for which it was built. New roads must be built. Thus, controlled access stops a road from growing old before its time.

The new law requires that public hearings must be held in every city, town and village that will either be bypassed or passed through by Federal-aid roads. When your state submits its plans to the Bureau of Public Roads,

Interstate Highway System Will Provide Safer, Faster and Cheaper Driving

it must attest that it has held such hearings for every community affected and reached its decisions on the routes after considering the evidence of such hearings.

That means there will be literally thousands of such hearings in the next 13 years. You may be called upon to attend one or more.

Many of those attending will not understand the advantages of "controlled access." Others will think if a town is "by-passed" business will be affected adversely. According to the U. S. Chamber of Commerce and many studies of by-passes this is not true. As a matter of fact, business usually increases. The "by-pass" relieves traffic congestion in the community and permits merchants' steady customers to drive to their stores easily, find a parking space and shop. Through traffic brings few customers. But it does discourage regular, local customers.

Legal Problems Arise

It is important that you should be able to explain these things to those who are not as well-informed.

A good deal depends on the laws of your state. Many states have passed legislation which permits them to move quickly . . . to start building roads almost immediately. Some states will have to revise their laws in order to avoid delay in taking advantage of the money now offered them by the Federal government.

For instance, some states are not permitted to acquire land and then control access to a highway built upon it. The new Federal law offers them help. A state, under certain conditions, can request the U. S. Secretary of Commerce to acquire rights-of-way for the Interstate System. The Federal government will do this, and hold title to the land until the state has laws which permit it to control access. Then the Federal government will turn the land back to the state.

Some states, too, have established a system whereby they can acquire land for roads well in advance of the construction date. This helps in many ways. For one thing, the state can often acquire the land before it is developed. That helps keep to a minimum the number of people who will be affected later on. And, of course, buying the road property in advance helps prevent the payment of inflated real estate prices.

To acquire land in advance and save money and trouble, some states have a special revolving fund. The state buys the land from this fund in advance. When the road is built the money is returned to the fund from the money authorized for the project.

The Federal government will help states building Interstate Highways to establish a procedure for advanced purchase of land for highways. It will advance Federal funds for this purpose to states if the state agrees to begin construction within five years.

Since States can build Interstate Highways—which are every bit as efficient as toll roads—by putting up only 10% of the cost, the use of tolls as a method of financing highways is expected to be greatly reduced.

And, of course, none of the new Federal-Aid roads will be toll roads. Federal money cannot be used for toll highways.

There probably will be a few toll roads. They will be the toll roads that now exist and which are on Interstate Routes. The law provides that toll highways may be accepted as links in the Interstate System on two conditions.

The first is that the toll roads will ultimately become free roads when the bonds are paid off.

The second is that there is a satisfactory *free* alternate route.

New and Increased Taxes to Obtain Federal Funds

A study is being made to aid Congress in determining whether to pay states for completed free and toll highways that meet Interstate standards and are on Interstate routes. This study will be submitted in January, 1958.

It is estimated that about 6,000 miles of toll and free highways that conform to Interstate standards and are in Interstate routes were in existence when the law was passed. It must be understood that the Interstate Highway System was laid out to serve traffic on existing travel routes. In other words, there are roads at present approximating practically every mile of those routes. But they are mostly inadequate roads—certainly not up to handling 1975 traffic.

This is a question each state will study for each project it undertakes. Often it is cheaper, particularly in heavily populated areas, to relocate highways rather than acquire a good deal more property along the old route for controlled access. It appears certain that there will be more relocated highways built than old highways brought up to Interstate standards.

About two-thirds of the needed Federal money will come from highway taxes *already in effect* before the Act was passed. One-third will come from new taxes and increases in rates made effective with the passage of the Act.

This act increased Federal gasoline taxes on tires from five to eight cents a gallon. There is a new tax of three cents a pound on camel-back recapping rubber. The tax on trucks and trailers and buses has been increased from 8% to 10% and a use tax has been levied on all trucks weighing more than 26,000 pounds.

New Roads Will Save Lives

Here is the biggest bargain a motorist ever got. According to the Bureau of Public Roads, you will get these 41,000 miles of high speed expressways and thousands of miles of other roads *for less than $9 a year additional.*

You will save many, many times that figure in slower depreciation of your car, lower insurance losses, saving of time. And how can you put a value on the 3,500 lives a year that are expected to be saved?

States have to put up only 10% of the cost of the Interstate System, and 50% of the cost of projects on the remainder of the Federal-aid road system.

However, for most states this means that the total annual expenditure for highways will be higher. They will need to appropriate more money for highways—but not a great deal.

The important thing to remember is that under the present program each state dollar will buy a good deal more highway construction than in the past.

Construction on the first new roads on the Interstate Highway System began a few weeks after the law was passed. Results will begin to be evident about 1960, but they will be well scattered throughout the 48 states.

It is well to remember that Congress did not authorize the entire $24.8 billion dollars Federal-aid for the Interstate System in a lump sum. Rather it was doled out over 13 years. So some projects on this system will not be started until about 1970. But by that time tens of thousands of miles will be completed.

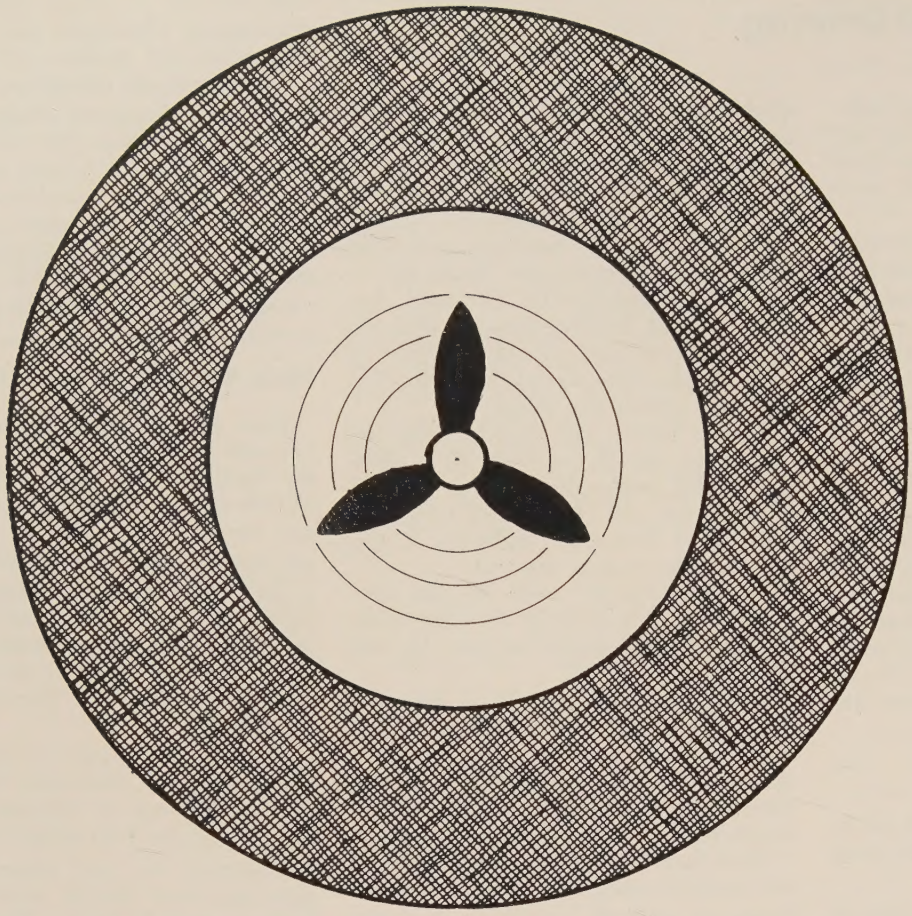
Despite its enormity . . . in the face of the many problems to overcome . . . the Interstate Highway System is expected to be completed in only 15 years.

To understand what an astounding feat of construction this is, compare it with the building of the Panama Canal.

Student (from the back of the room): "Are you sure the third test question is in the book?"

Prof: "Certainly."

Student: "Well, I can't find it."



THE AUTOMOTIVE

Four major metals may soon take over construction work in the automotive industry, reports Product Engineering. As other metals become scarcer, iron, aluminum, magnesium and titanium, plus silicon, will come to the fore. These may be followed by ceramics and ceramic metal compounds.

American motorists may soon be riding on smaller wheels, reports National Petroleum News. Car manufacturers are producing 13-inch wheels and tires on an experimental basis. The wheels are proving satisfactory, but designers are having trouble shrinking the brake drum.

In answer to this, liquid-cooled brakes may soon appear on the market, reports Road and Track magazine. Raybestos-Manhattan has a system which bonds the linings to the brake drum and runs cooling water through the brake shoe. As the shoes do not rotate, there is no problem of seals or leakage. Under test for five years, it is claimed that the new system is fade-resistant, inexpensive, long-wearing, and does not affect standard cooling systems.

The National Bureau of Standards has developed a precise, direct method for determining tire operating temperatures. The procedure involves the use of a copper-constantan thermocouple inserted through the tire valve. When the tire is rotated under load, the thermocouple gives a precise measurement of the average contained-air temperature. Intended for tire research and evaluation studies, the procedure was developed by the Bureau staff and sponsored by the Federal Facilities Corporation, Office of Synthetic Rubber.

This year offers an exceptional array of things the well-dressed car will wear, reports American Machinist of metalworking production. They'll have tachometers to check speed; built-in consciences for your speedometer, ranging from a red glow to Bermuda bells; warning lights to supplement virtually every instrument on the dashboard; and a radio that automatically hunts up another station when one goes off the air.

A self-deflecting rear-view mirror has been designed that should be a boon to night drivers' eyes, Electronics says. A photocell is mounted over the rear-view mirror. When headlight glare from a following car is too bright, the mirror is deflected.

Completion of the 3880 acre Michigan Proving Ground gives Ford its big-

there will appear an

exceptional array of improvements

in the autos of tomorrow!

edited by Dennis Lantz

INDUSTRY ROLLS ON

gest testing facility. The company also maintains a 3,840-acre desert proving ground near Kingman, Ariz.; a 360-acre test area in Dearborn, Mich., and test stations at Jennerstown, Pa., and Colorado Springs, Colo. Together, these five areas, totaling 8,080 acres provide Ford Motor Company's 300 test drivers with some of the auto industry's most extensive facilities for testing all types of motor vehicles.

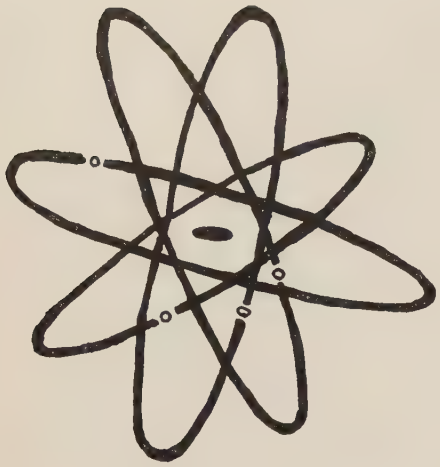
Feature of the new Michigan facility is a five-mile, oval high-speed test track which is five lanes wide and can accommodate safe high-speed driving on its steeply banked turns. A 2½-mile straightaway adjacent to the oval track is for checking acceleration and braking performance. Completely level, it was built to coincide at every point with the curvature of the earth so the force of gravity would be constant along its entire length. Three durability roads provide all types of dips, curves and surfaces for testing vehicles. Test hills range in grade from 7 to 60 per cent, with the latter too steep for most passenger cars but designed to test experimental military vehicles now under development by Ford.

Flatter tires, now used only on one model car will be standard equipment on 1959 passenger cars, predicts Petroleum Week. The low-profile tire has a wider, flatter cross-section. It permits a lower over-all height without going to a smaller wheel diameter.

Push-button gasoline sales may be just around the corner. If a new experimental preset device is successful, station attendants will be free to spend more time on service and salesmanship. The new device enables the attendant to push one of eight buttons and be sure the pump will deliver a specific dollar or gallon amount into the customer's tank.

White is today's favorite in car colors. In 1954, blue was the most popular with 30 per cent of the sales. One company explains the change this way: Blue seems to rise as the stock market rises. White may be an index of instability, while black, green and gray advance as the markets drop.

An electroencephalograph is being used to test the length of time drivers remain alert, reports Electronics magazine. In a recent test, brain waves showed drowsiness sets in after 90 minutes. Recorded engine and traffic noises are used to add to the realism of the test.



ATOMIC EVENTS

PROGRESS: Atomic Cruiser and Sub

NEW: Atomic Washing Machine

DIFFERNT: Atomic BB's

Atomic Cruiser

The U. S. Navy's first nuclear-powered surface ship, a cruiser which will be armed with guided missiles for both offensive and defensive fire power, will be powered by main propulsion equipment from the General Electrical Company. The order amounts to over $4,000,000 and includes both the main propulsion turbines and reduction gears for the atomic-powered vessel. The vessel, which will cost approximately $87.5 million, will be built in Quincy, Mass.

Twin screws will propel the ship. A General Electric cross-compound steam turbine will drive each propeller through a G-E double-reduction, locked train gear set. The saving in weight gained through the use of such gears will increase the ship's capacity for the carrying of more electronic and fire control equipment.

Triton

A submarine hull section is nearing completion at nearby West Milton, N. Y., which will house the prototype of the nuclear propulsion plant for the Navy submarine, Triton.

The prototype plant and actual nuclear propulsion plant for the Triton are being designed and developed at the Knolls Atomic Power Laboratory (KAPL), which the General Electric Company operates for the Atomic Energy Commission.

The Triton now is under construction at Groton, Conn., by the Electric Boat Division of the General Dynamics Laboratory. The Cruiser is designed to operate in conjunction with a fast carrier task force and to provide the task force with radar information.

The Triton will be powered by two pressurized water reactors, designated SAR (Submarine Advanced Reactor), and will be the first two-reactor plant ever developed for submarine propulsion.

Atomic bb's

Little steel bb's—35 tons of them—are being installed as the shielding in a new "hot cell" at the Westinghouse Materials Engineering Department's radiation and nucleonics laboratory. The cell has half-inch-thick steel walls spaced 15 inches apart. Between these walls are the 35 tons of bb's—equal to 10 inches of solid steel in their ability to "contain" atomic radiations. Use of the bb's makes the hot cell portable, since the shot can be drained through special openings near the base of the walls. The new Westinghouse hot cell will be used for examining the effects of a nuclear "environment" on reactor materials, for studying the usefulness of atomic radiations in industrial processes, for finding ways to utilize the radioactive by-products from nuclear power plants and for related atomic and nuclear research.

Hot Washing Machine

Something new in washing machines —one that solves tough wash day problems without water for cleansing — is in service at the huge Hanford atomic plant, operated by the General Electric Company for the Atomic Energy Commission.

The Hanford machine, however, does not wash clothes. It cleans uranium fuel slugs after they have been irradiated inside nuclear reactors.

Bolted to the floor under 11 feet of water, the washer bathes 16 fuel elements in acid to remove the oxides and film formed under nuclear pile irradiation.

Other water-filled basins in this specially designed and equipped laboratory contain equipment for photographing the irradiated slugs, apparatus for measuring their gamma ray intensity, as well as a special device for determining the core grain size of the uranium. All of these tests are conducted without ever bringing the "hot" specimens to the surfaces of the pools.

New Developments in Jet Aircraft

Jet Transports

Last Autumn the Air Force provided the aircraft manufacturers with the incentive to take a look at the executive-type turbine transport market by announcing it would like to purchase up to 1,800 light jet utility transports. This interest on the part of the military, coupled with the desire of corporate aircraft users to purchase modern equipment, has led to the offering of four new turbine transports in the executive category. These are in addition to the Fairchild M-185 four-jet transport already announced.

America's first jet utility transport—the 10-passenger Lockheed Jet Star—successfully completed its maiden flight, beating by two minutes a date-in-the-sky set when engineering started only 241 days ago.

The sweptwinged Jet Star broke ground off the Edwards Air Force Base runway at 8:58 a.m. on a 39-minute flight described by Pilot Ray J. Goudey and Copilot Robert Schumacher as "silky smooth."

Setting a new record of 34 weeks from start of design to first flight, the 500-mph plane was developed specifically to meet Air Force requirements for a small, speedy, versatile transport providing jet performance for "utility" needs. The Jet Star has a range of 1700 statute miles but can extend the distance with external fuel tanks.

"It's fast—plenty fast—and handles as responsively as a well-trained racehorse," Goudey reported.

"We had to throttle back even on takeoff and then again during the flight to keep pace with our chase plane.

"With jet engines located behind the cabin, the cockpit and passenger compartment are so quiet that conversation can be reduced almost to whispers."

The Jet Star measures 58 feet—from sharp-pointed nose to tail. Mounted high on the vertical fin, the horizontal stabilizer is completely out of the path of jet exhausts. The wing span is 53 feet.

Two Bristol Orpheus engines, mounted in pods behind the wings on each side of the rear fuselage, deliver 10,000 pounds of takeoff thrust for this first prototype.

A second prototype due to fly next year will be powered by four General Electric J-85 or Fairchild J-83 engines when they become available.

Both planes will cruise at more than 500 mph at 40,000-foot altitudes.

"This new airplane can perform multi-purpose utility and support missions economically," Gross said.

"It is designed for high-performance training. It is adapted to fill high-priority military transportation needs—such as travel between key command posts. It can move critically needed items swiftly, and finally it offers added advantages as a multi-jet crew trainer and air evacuation transport," he said.

To meet military requirements, Gross explained, a much smaller aircraft than a standard jet airliner was needed.

"In the vast majority of instances, neither the number of people nor the kind or size of cargo would justify the use of a large airliner. This airplane will perform these missions at speeds equal to those of a large jet airliner—at a fraction of the cost," he added.

"Any expansion in the project beyond the prototype stage depends upon military acceptance of the airplane," Gross said.

The prototype is designed to carry 10 passengers and a 2-man crew. The configuration is such that additional seats for passengers as needed can be provided in the production models.

Designed as virtually a self-contained unit, the new utility jet requires a minimum of special ground handling equipment.

Most unusual feature of the new model is the pod arrangement of the engines.

"The rearward location, which Lockheed engineers selected after seven years of jet transport design study, offers many important advantages," Gross pointed out.

Attached to the rear of the fuselage, they are completely clear of passenger or fuel areas and independent of the airplane's low, uncluttered wing. They are easily accessible for maintenance.

Among other advantages are lower cabin sound levels, a result of installing engines behind the passenger area.

"Flight comfort compares with—or exceeds—that of a large jet airliner," he declared. "Completely pressurized and air-conditioned, the cabin is climatized to 8000-foot altitudes when the airplane flies at 40,000 feet."

Location of the powerplant inlets behind the wing—which also serves as protection — virtually eliminates the likelihood of picking up pebbles or debris during ground runs.

The new trainer-transport's wing is swept 34 degrees along the leading edge and has an area of 523 square feet. Over-all height of the plane is 21 feet.

A "flying stabilizer" attached to the fin—a design worked out for the experimental Lockheed XF-90 penetration fighter—provides excellent rigidity with resultant anti-flutter and minimum drag characteristics.

A dive flap at the bottom of the fuselage also serves as a means of access to the rear baggage compartment.

The new utility jet incorporates standards set by the Civil Aeronautics Administration as a result of studies on forthcoming commercial jet airliners, Gross pointed out.

"Thus, while Lockheed designed the

airplane according to military needs, it will also be eligible for CAA civil certification," he said.

Compact and simple, the cockpit is furnished with complete radio and navigation equipment for transport operation. The windshield meets latest visibility requirements of the Civil Aeronautics Administration and the Society of Automotive Engineers.

The airplane's military designation is "UCX"—U for "utility," C for "transport" in USAF terminology, and X for experimental prototype.

Another contender in the jet field is the four-place Sabreliner that North American expects to fly next March. In the turboprop class there is the On Mark Marksman 450 and Grumman's 159. The information that has been released on these transports is limited, but some of the specifications are given in the above table:

	Lockheed Model 329	*North American Sabreliner*	*Gruman 159*	*On Mark Marksman 450*
Gross weight	32,400 lb	14,350 lb	31,000 lb	40,000 lb
Passengers	10-12	4	12	Up to 14
Empty weight	14,670 lb	Unavailable	19,000 lb	23,000 lb
Cruising speed	Over 500 mph	500 mph	370 mph	436 mph
Max. range	1,730 miles	1,500 miles	1,760 miles	3,100 miles

Jet Metals

Westinghouse scientists have developed a new high-strength, high-temperature metal which is designed to help push back the "heat barrier" now being encountered by jet engines in the nation's new supersonic aircraft.

As jet planes travel faster and faster into the realm of supersonic flight, they encounter what is commonly called the 'heat barrier'—excessive heating of the plane due to its own impact with the onrushing air. It is the same phenomenon which causes a meteorite to burn to ashes as it falls at high speed through the earth's atmosphere. In aircraft, this heating creates many serious problems, not only in the general structure of the plane, but also in the jet engine which powers it.

Impact heating is now a major consideration in the design of the inlet and compressor of modern jet engines. By using titanium for those parts that were formerly made of aluminum, magnesium and low-alloy stainless steels, engineers can protect these sections of the engine from the effects of impact heating without sacrificing the turbojet's light-weight advantage.

However, back in the turbine section of the engine exists what might be called a second "heat barrier" which is proving to be a much more difficult problem for the turbojet designer. A jet engine gets its energy for propulsion by increasing the temperature of the air passing through it. As a general rule, the greater the increase in air temperature, the more thrust a given engine will produce and the faster the airplane will fly. If the speeds of new fighters, bombers and missiles are to continue up the supersonic scale, their engines must be able to run at higher and higher temperatures and they must do this without having any of their components suffer significant losses in mechanical strength. The new Westinghouse metal is intended as a structural material for use in the turbine section of the jet engine, where the hottest moving parts are found. It offers special promise as a material for constructing turbine discs.

A jet engine turbine disc is a metal wheel that is bolted to the aft end of the rotating shaft of the engine. Anchored to its outer rim are some 50 or more turbine blades. White-hot gases from the burning fuel push against the blades and spin the disc and shaft at speeds up to 20,000 revolutions per minute. The disc, whirling at red-hot temperatures, undergoes stresses as great as 50,000 pounds per square inch.

Present materials for turbine discs and blades are pushed to the limit by today's jet engine requirements.

The new material, which is referred to simply as W545, is an alloy of six essential elements: iron, nickel, chromium, and in smaller proportions, molybdenum, titanium and boron.

Increasing the operating strength of temperature of a high-temperature alloy can be done by adding greater quantities of these ingredients which cause hardening in the alloy. However, this procedure usually results in a loss of ductility, causing the alloy to become brittle and more susceptible to fracture. This low ductility starts to grow during the hardening process when imperfections and dislocations of the atoms occur along the individual grain boundaries of the alloy. It appeared likely that one solution to the problem might be to fill up these spider-web lines of brittleness to make the precipitation reaction more generalized within the grains rather than concentrated at the boundaries. This called for an element whose atom was of such a size that it would not merely move in and be a substitute in the alloy lattice for one of the iron, cobalt, nickel or chromium atoms, which are all about identical in size. It would also have to be a larger size atom than carbon, nitrogen, or oxygen which can actually slip inside the crystal lattice of the alloy. The element boron fllled the bill. Approximately ¾ the size of the iron atom, it is too small to be a substitutional-type atom and too large to be the interstitial type.

Basically, W545 is a modified version of Discaloy, a high-temperature alloy first developed at the Westinghouse Research Laboratory some ten years ago, and an outstanding turbine disc material in its own right.

Soviet Jets

Four new types of Soviet civil aircraft designed to re-equip the national airline Aeroflot in the near future were shown at Moscow Vnukovo Airport last month.

Reports in the Soviet Press name these as the Tupolev Tu-104A, the Tupolev Tu-110, the Antonov An-10 Ukraina (pictured in *Shell Aviation News* No. 229) and the Ilyushin Moskva. The Tu-104A is reported to have a better range than the Tu-104 from which it is derived, and is likely to be used on the Czechoslovak Airline Prague-London route for which agreements have been reached with BEA.

The four-engined Tu-110 turbojet is again a larger, more advanced version than the Tu-104. It is to be built in a luxury version for 78 passengers and also in a 100-seat tourist layout. Its maximum speed is reported at 540 kts and range 2,000 nautical miles. The fuselage and wings have been lengthened and the jet engines arranged in pairs at the wing roots, as in the Comet, but no other major structural changes appear.

The Ilyushin 11-18 Moskva is a large capacity, medium-range turboprop very similar to the Vanguard and Electra in design and performance. With fuel reserves for one and a half hours, it has a range of 2,700 nm and a cruising speed of 350 kts at 26,000 to 33,000 ft. The empty weight of 28 tons, and gross weight of 58 tons reveal a favorable ratio of useful load to gross weight.

The Moskva is designed to the "fail-safe" principle of duplication of load-bearing parts and double-pane windows. The economic fuel consumption of four NK-4, 4,000 hp turboprops, allied with low cost airframe structure, is reported to result in a particularly low level of fares.

Finally, a new Tupoley transport, due to fly in October, is the turboprop Rossiya referred to as a 180 passenger, 4,300-mile liner, powered by four 12,-000 hp Kuznetsov engines and with a speed of 550 mph.

High Temperature PHOTOS

Camera Utilizes Rainbow Colors

Blast furnaces, open hearths, coke ovens, and other steelmaking facilities appear in all the colors of the rainbow through the lenses of an "evaporgraph," a new type of camera now in use for the first time in the steel industry at U. S. Steel's Fairless Works in Fairless Hills, Bucks County, Pennsylvania.

Developed by Baird-Atomic, Cambridge, Massachusetts, as a direct thermal-imaging device, the new instrument functions as efficiently in absolute darkness a's in daylight, requiring no source of external illumination. Instead, it forms a colored, two-dimensional image by utilizing the long-wavelength, infrared radiation emitted from the object or area being photographed. The image is made visible by a light source inside the instrument. Sensitivity of the device is such that differences of as little as 1-degree Centigrade (1.8 degrees Fahrenheit) can be detected in the target temperatures. It will function so long as the target temperature is above zero and there is a temperature difference existent in the field of view. Objects as distant as three miles or more will register accurately in the evaporograph.

The new instrument was first brought to the publics attention in color in the July 30, 1956 issue of *Life* magazine.

Test observations and color photographs made with the instrument throughout the mill area have shown that temperature differences on the exterior surface of high-temperature operating units make possible the study of interior wall conditions in such installations as open hearths and blast furnaces. Thus, the evaporograph answers a long-time need of operation and maintenance departments in steel mills. It shows promise also as a detector of hot-spots or worn areas in machinery, steam lines and other auxiliary mill equipment where temperature is a measure of interior conditions.

The heart of the new instrument is the evaporograph cell, a vacuum-enclosed membrane on which a thin film of oil condenses.

The membrane is made of nitrocellulose about 4 micro-inches (0.000004 inch) thick, mounted on a metal ring. When the membrane is illuminated with white light, interference between light reflected from the front and rear surfaces of the membrane has the effect of cancelling certain wave-lengths in the incident light and gives the membrane a colored appearance. Thickness of the membrane is controlled so that it exhibits a yellow interference color.

One side of the membrane is lightly blackened with vaporized gold deposited under high vacuum to absorb the energy incident upon the membrane from that side. The membrane is then mounted in a cell with the coated side toward the infrared optical system. This side of the cell is sealed with a sodium-chloride window which will admit radiation up to a wavelength of approximately 19 microns.

The other half of the cell is lined with oil-saturated blotting paper and sealed with a special glass having a conducting layer facing the membrane. A slight electrical current passes through this layer and heats its surface to prevent any oil condensation from obscuring the membrane. A small heater covers this half of the cell to permit it to be heated a few degrees above the ambient temperature.

In use, air is evacuated from the cell and the rear half is heated slightly to increase the vapor pressure of the oil. Just as water will condense on a cold glass in hot weather, the oil starts to condense on the nitrocellulose membrane.

If the image of an object is focused on the blackened side of the membrane, different portions of the membrane will

(Continued on Page 37)

THE THEORY JACK BUILT

This is the Theory Jack built.

This is the Flaw
That lay in the Theory Jack built.

This is the Mummery
Hiding the Flaw
That lay in the Theory Jack built.

This is the Summary
Based on the Mummery
Hiding the Flaw
That lay in the Theory Jack built.

This is the Constant K
That saved the Summary
Based on the Mummery
Hiding the Flaw
That lay in the Theory Jack built.

This is the Erudite Verbal Haze
Cloaking Constant K
That saved the Summary
Based on the Mummery
Hiding the Flaw
That lay in the Theory Jack built.

This is the Turn of a Plausible Phrase
That thickened the Erudite Verbal Haze
Cloaking Constant K
That saved the Summary
Based on the Mummery
Hiding the Flaw
That lay in the Theory Jack built.

This is Chaotic Confusion and Bluff
That hung on the Turn of a Plausible Phrase
And thickened the Erudite Verbal Haze
Cloaking Constant K
That saved the Summary
Based on the Mummery
Hiding the Flaw
That lay in the Theory Jack built.

This is the Cybernetics and Stuff
That covered Chaotic Confusion and Bluff
That hung on the Turn of a Plausible Phrase
And thickened the Erudite Verbal Haze
Cloaking Constant K
That saved the Summary
Based on the Mummery
Hiding the Flaw
That lay in the Theory Jack built.

This is the Button to start the Machine
To make with the Cyberenetics and Stuff
To cover Chaotic Confusion and Bluff
That hung on the Turn of a Plausible Phrase
And thickened the Erudite Verbal Haze
Cloaking Constant K
That saved the Summary
Based on the Mummery
Hiding the Flaw
That lay in the Theory Jack built.

This is the Space-Child with Brow Serene
Who pushed the Button to start the Machine
That made with the Sybernetics and Stuff
Without Confusion, exposing the Bluff
That hung on the Turn of a Plausible Phrase
And, shredding the Erudite Verbal Haze
Cloaking Constant K,
Wrecked the Summary
Based on the Mummery
Hiding the Flaw
And demolished the Theory Jack built.

Stolen from *The Atlantic,* Dec. 1956
with the aid of *The Colorado Engineer,* May, 1957

LAR at night

Far though it may be from North Campus, Lincoln Avenue Residence Hall is well known to most engineers. Within its ivy-covered walls live 542 girls, soon to be joined by the more than 600 which Allen Hall, just west of it, will hold.

Isolated though these charmers may be, they are certainly seldom lonely, for the "ratio" guarantees them many admirers. Understandably, these gentlemen are loathe to leave the premises, for a great number of them are pinned or engaged to the lovely lassies of LAR.

This preference they have for staying around, and the residents' willingness that they do so leads to a large number of people in the lounge. As a reader service, TECHNOGRAPH here presents the story of that lounge.

The lucky ones find seats . . .

. . . the others have to stand

some prefer the back of the lounge . . .

. . . while others line up in the hall

And so, good night . . .

These pictures represent a normal evening at LAR, as vouched for by much of our staff. We accept their authority on the subject, although for once, none of them was in the lounge when the pictures were taken.

BRAINTEASERS

1. Take the four Aces, Kings, Queens and Jacks out of a deck of cards and lay out four of the cards as shown below:

J-D A-C Q-S K-H

Place the remaining twelve cards in three rows below, such that no two alike cards (either in value or in suit) are in any row, any colum, or any diagonal.

2. A certain coeducational institution is reported to have made a special effort to inculcate good manners in the students. It was, we are told, the custom each morning to follow this procedure: Every girl made a bow to every other girl, to every boy and to the teacher. Every boy made a bow to every other boy, to every girl and to the teacher. There were twice as many girls as boys. In all, there were exactly 900 bows made each morning. How many boys were in the school?

3. On train there are three passengers, Mr. Smith, Mr. Jones and Mr. Robinson, there are also an engineer, a brakeman, and fireman whose names are Jones, Smith and Robinson. Mr. Robinson lives in Detroit. The brakeman lives halfway between Detroit and Chicago. Mr. Jones earns $8,000 a year. Smith beat the fireman at billiards. The brakeman's nearest neighbor, one of the passengers, earns three times as much as the brakeman who earns $4,000 a year. The passenger whose name is the same as the brakeman's lives in Chicago.

What is the name of the engineer?

4. Over the top of a fence there is placed a rope, the same amount on both sides. The rope weighs one-third pound per foot. On one end of the rope hangs a monkey holding a banana, and on the other end is a weight equal to the weight of the monkey and the banana. The banana weighs two ounces per inch. The length (in feet) of the rope is as long as the age of the monkey, and the weight of the monkey (in ounces) is as much as the age of the monkey's mother. The combined ages of the monkey and its mother are thirty years. One-half of the weight of the monkey plus the weight of the banana is one-fourth as much as the weight of the weight and the weight of the rope. The monkey's mother is one-half as old as the monkey will be when it is three times as old as its mother was when she was one-half as old as the monkey will be when it is as old as its mother will be when she is four times as old as the monkey was when it was twice as old as its mother was when she was one-third as old as the monkey was when it was as old as its mother was when she was three times as old as the monkey was when it was one-fourth as old as it is now.

How long is the banana?

5. Find the digits represented by the letters below if no two letters represent the same digit.

Slap	Slap
+ DEB	DEP
Dude	PIPS

6. A. It's as far from OMSK to UMSK as from AMSK to MONSK.

B. It's as far from MINSK to MUNSK as from MANSK to MONSK.

C. MONSK is on a straight road from MINSK to UMSK.

D. MONSK is on a straight road east from OMSK to MUNSK.

E. AMSK is 8 miles north of OMSK and 8 miles west of UMSK.

F. MANSK is 6 miles south of MUNSK and 6 miles east of MINSK. How far is it from OMSK to MINSK? How far is it from UMSK to MUNSK?

7. This will take a little time, but it is really quite simple. Just find the integers that are represented by these letters. As a starter, Y = 7

```
      SUSY
  ------------
MSU ) DEMURE
      SRE
      ----
      MARU
      MAST
      ----
       DTR
       SRE
       ---
       UKE
       UKE
       ---
```

8. If two locomotives start from two cities 132 miles apart headed toward each other on the same track, and if a fly flies back and forth between the headlights of the two trains as they speed to their own (and the fly's) destruction, how many miles will the fly fly before he is crushed to death by the two headlights? One locomotive travels at a constant speed of 83 miles per hour; the other at 37 miles per hour. The fly does 7 miles per hour.

(Continued on Page 62)

Crated . . .

Alfred never thought constructively about his future

Alfred J. Prufnick had reached the estimable age of 17, had grown a soft yellow beard which already was 1/8 centimeter long, and knew the rudiments of chemistry and physics as the local college textbook had set them forth.

Alfred J. Prufnick, with these achievements, felt himself a complete man whose future growth would only be a matter of repetition, or if anything more productive, height. As far as any external stimulant to growth was concerned, there was nothing else but the food which he ate.

If one asked him what the world was made of, he would immediately reply at the snap of a finger.

"Why, tiny particles, moving at fantastic speeds through space."

"And, what my lad, is space?"

"Why, space is that which assures motion."

And he would run his slender fingers down the sides of his face like a sage divining great truths from the Testament of Moses. Then he would excuse himself and vanish into his imaginary chamber, furnished with great quantities of glistening glass tubes and pipes, leading to the heavens and relaying the secrets of the cosmos through a circuit private to his alert ear.

But no one asked him these questions, although he was well rehearsed in case any scholar should happen to meet with him. Many times he had stood before his silently philosophic mirrors, watching his dark eyebrows bob up and down impressively and his jaw strut proudly as he opened up the eyes of an admirer to the simple facts of existence.

Alfred had become quite early in his teens, the bane of his parent's life. One had to admit he was too studious to condemn; yet there was something annoying about his prophetic air. While his father, who held a very innocious position as clerk in a powerful industrial firm, expounded political economy to his credulous wife, Alfred would invariably interrupt with:

"And of what importance is the Smith Bill when we consider how insignificant we all are."

Then he would return to his plate and devour great quantities of meat with which to nourish his insignificant body.

In school, Alfred exhibited utter contempt. While the physics class was engrossed in an illustration of a cloud chamber, make-shiftly constructed out of coffee jars and pie tins by the class brilliants, he would sit silently in the back of the room, his eye wandering out past rows of apartment buildings out of the window, out into a private region where cosmic rays were all powerful deities, not mere dancing spots on a wrinkled black cloth; and the only thing left of Alfred J. Prufnick would be a sly, contemptuous smirk.

Alfred never thought constructively about his future. In his scheme of things there was no future, nor past, nor even present: Only ideation, which precluded natural events. Ideation transcended people, classes, dates, giggling girls, athletics, and school activities. Ideation was aimed at the skies, trying to divine their great design and capture it in crude markings on a sheet of fresh white paper. So while his father scribbled into the night beside his agreeable wife, juggling figures so that Alfred could receive the costly education in law and medicine, the young boy would be tassling with his own newly conceived ideational theory.

Mr. Prufnick would enter a figure in an elaborate system of auditing, mumbling inaudibly to his wife.

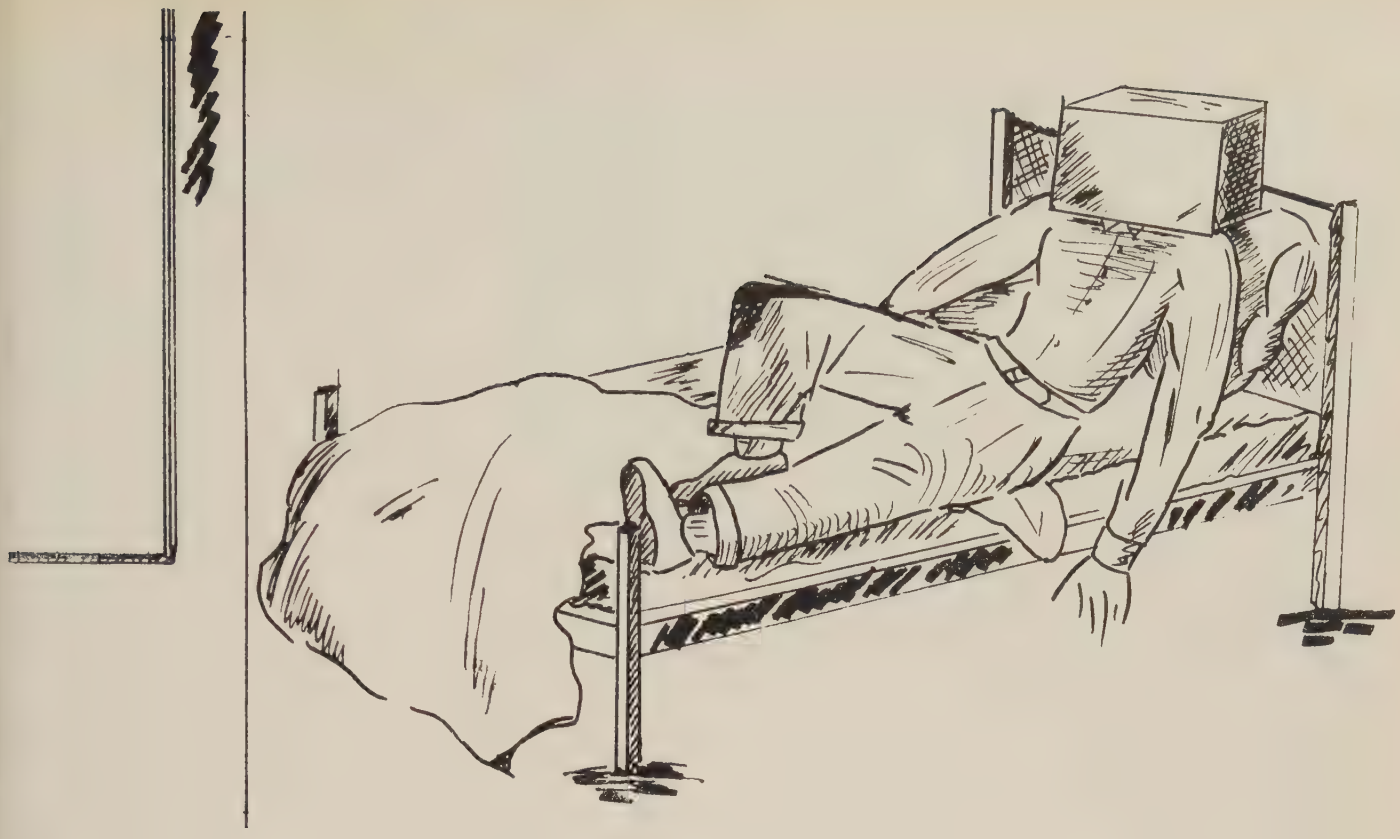
"See, see Eva. If we set this figure aside right over here. There. Now he cou'd maybe go to Harvard. Harvard for law my dear."

"Yes, Emil. Yes dear."

"And Eva. Look here. If we can only invest this over there. We'll be secure then. Just in case Alfred shouldn't—well, just in case."

"Yes. You're so wise Emil."

And during all this, Alfred would toss and turn in his narrow bed shutting out all thought for eternities of time, then relaxing in one instant, trying to capture the impetus of every idea. He had discovered already that no one of his ideas followed from a chain of reasoning. At least none of his brilliant ideas. And even those which were not so brilliant, but which he could not trace to any previous knowledge or inference from any previous stream of thought. But instead, each fresh idea seemed to emerge from no where, like a spark which had its causes to be sure, but where are they once the spark has emerged? Like and hot and cold, who each depended upon the other, yet where was cold when heat was felt and didn't heat vanish when cold was sensed? It was no use tracking things down to irreducible elements. You had to either treat things as if they were according to your theory, in which case you were always falsifying and distorting from lack of information, or you must dis-



pense with your theory altogether, in which case you might as well give up your inquiry. There seemed to be no middle ground. Ideational theory was a gross issue, not one which could be explained by still more mysterious entities, if you could even presume to call neural impulses entities.

Alfred kept a wide loose leaf notebook in which he recorded his nightly efforts. One night he had set about refuting Euclid's axiom. But where had he gotten the idea that a straight line was an ambiguous term? What else could a straight line be but what was illustrated by the side of a triangle or the edge of his ruler. Yet he sensed another type of straight line, existing beyond measurement, that betrayed Euclid and made his brilliant geometry, revered through the ages, an isolated and restricted study.

And Alfred was only 17 and knew the rudiments of chemistry and physics.

Mr. and Mrs. Prufnick were not surprised when Alfred failed to come down to breakfast early one Sunday morning. The radio had been full of announcements regarding the prominence of the planet Mars which was to be glowing red in the sultry summer sky all that evening. Alfred had probably stayed up to watch it and was still sleeping. Breakfast over, the elder Prufnick retired to the living room to read the market reports leaving his agreeable wife smiling over the dishes.

It was already noon before Emil Prufnick returned to the kitchen inquiring after Alfred.

"He hasn't come down yet, then?"

"No, Emil. He's probably tired from all that watching. Don't wake him yet."

"What a boy, Eva. What a boy we've got here. Why doesn't he watch his pocket book that close."

"Come now Emil, he doesn't spend anything. He never goes out at all."

"Does he earn anything. Does he go out and work? Get a job in a store, sweeping, or at the butchers. Or a newsstand, like the others, like I did when I came over here. On a newsstand I worked, Eva."

"I know dear. I know you worked hard, and in the cold."

"All he does is his watching, and his studying late at night when we were asleep. I used to watch him. He knew the Talmud from cover to cover. But our boy, he won't even go to the Heder anymore."

Emil sighed a great sigh and lit up a smelly pipe as his wife prepared the noon meal, in their small but immaculate kitchen. The noon meal was over, and soon it was one o'clock and then two and finally Emil called angrily to his wife from the bedroom.

"Eva, call Alfred down here already. He's been sleeping all day."

"I know Emil. Maybe he's sick though. I'm afraid to go up."

"Sick. Sick. How could he be sick. He was alright yesterday wasn't he. He didn't have a cold or anything?"

"Go up there Emil. You go yourself. Maybe he's sick."

The father came out of the bedroom moodily and headed up to the attic where Alfred had made himself a quiet study. He stood at the head of the stairs and gingerly opened the door not without apprehension. Once he had caught his son in an embarrassing position, during one of Alfred's rehearsals before the mirror, and he spent many days in despondency trying to eradicate the impression of his own son parading before a mirror, showing off his gangly young body in an unhealthy solitude. Now he opened the door gingerly and scanned the room quickly. There was Alfred bent over the desk, or in the closet, or sitting in the overstuffed chair with a book. When he finally caught sight of his son, he gasped and closed the door, shutting his eyes to the task of another look, and collapsed in a worn heap on the top step.

"Emil, is he allright?" Eva came to the foot of the stairs and taking one look at her husband flew into a fit of hysteria.

"What is it? Emil. Speak. What is it already? What's happened?" She ran from the steps into the kitchen, clutching her apron in her hands and wringing it frantically. Then she ran back to the steps and pounded on the wall out of sheer impotence.

"Please Emil."

"It's nothing. Go into the kitchen. It's nothing Eva."

"No. Tell me. Can I come up. Is he . . .?"

"No. Go into the kitchen. Hear?"

Emil spoke sternly and his wife followed his voice into the kitchen and sat at the table wringing her hands and tugging at her hair rocking back and forth in her chair, uttering chant-like cries.

. . . this thing was on my head

Meanwhile the father, had propelled himself back into the room and was gazing at his young son on his back in his narrow bed, his head and neck encased in a large wooden crate. The father approached him slowly.

"Alfred. Can you hear me? It's your father talking."

"I can hear you Pa." His voice was muffled coming through the thick wooden boards.

"Alfred. What can I do for you? How can I take this off?"

"I don't know Pa. I can't answer you."

"Does anything hurt?"

"Pa. I feel fine. I never felt better. Really. If I could only eat I'd be real happy. Is Ma worried? Tell her not to worry because I'm just fine."

"But we've got to get you out of that—out of there. You can't stay there. Think of how that'll look?"

"I don't care. I like it in here. I feel real rested Pa."

"You stay there now, don't move. Don't move now, you'll strain yourself."

Emil rushed out of the room and wiped the perspiration off of his forehead before he began to descend the stairs. He tried earnestly to regain his composure before he should have to explain to his wife what he had seen. What could he say? That his son was lying in his bed with an apple crate on his head. It was absurd. How should she believe it. How could he believe it except that he had seen him lying there in his thin blue jeans with an old brown shirt. Fully dressed, in his socks and sneakers too. As though he were resting on his bed. But that apple crate. Or orange crate, whatever it was, he hadn't really gotten a look at it. It was not a strange crate. The boards looked worn and dirty and rusty nails hung out from various corners as though at one time the boards had been pried open and then pounded shut again, bending the nails and causing them to rust in the open air. Perhaps the boy in a gesture of wildness was playing a joke. Perhaps he had brought that crate home and covered his head with it only to scare his family. Emil was about to rush up again in anger and demand an explanation, when he remembered the boy's reserve and calmness. Certainly, if he were playing a joke he would have laughed, or maybe cried, but he would have done something, not lie there and say he was happy and rested. Alfred never played jokes, he was a serious boy, and the only time he ever approached his family at all was to berate them for their ideas. If it were a joke, Alfred was not playing it.

He walked into the kitchen and embraced his wife comfortingly.

"Now Eva. Don't get all upset. The boy is sick. I'm going to call the doctor and everything will be all right."

Eva looked up, reassured. "He's got a temperature? Maybe I'll bring him up some hot soup."

"Not for breakfast Eva," he reminded her. He stooped into a cabinet and picked up the heavy phone book, found the number he wanted and placed his call. Meanwhile Eva watched his every movement trying to discern the trouble on his harsh face.

"Emil, can I get him anything?"

"Ssh. No. Just wait 'til the doctor comes."

He finished his call and reassured that the doctor would be coming soon, and that he hadn't made him suspicious or worried his wife by repeating what he had seen over the phone, he sat beside Eva at the kitchen table holding her hand gently and puffing on his dark, well smoked pipe.

The doctor took one look at Alfred Prufnick and refused the case. He had been led up to the attic by the worried father, under the pretense that Alfred had a common human disease. He was not sure what exactly, but he felt sure it was probably a flu, for which he could write out a useless prescription, collect his fee and leave. The Prufnicks had been good patients in that way. They never were seriously ill, they usually appreciated the prescriptions, and they always paid the bill. His medical practice threatened by this oddity, which he had always intuited would happen to Alfred, he had nothing but curses for Emil's ears and upon the rare child he had raised. He left giving Eva a sympathetic look and refusing Emil's $5 bill. This much help he could still offer. But Emil Prufnick was left with his son and his crate and an unknowing wife. The doctor had promised to send over an associate to examine Alfred. But how many others would he tell and what if this should get into the papers and have reporters screaming at the doors and women looking in to see the crated youngster, his son. Eva's little boy.

He returned to the attic and sat on the edge of the bed watching the slow, even breathing of his scrawny son. The boy did seem more rested. His nervous twitch was gone from his hands which were folded lightly on his stomach. His body was perfectly still and he appeared to be sleeping. The father bowed his head and thought the painful thoughts.

"Pa. Is that you?"

"I thought you were sleeping."

"I was, for a while."

"The doctor was here. Did you know that?"

"No. Who, Dr. Stern? What'd he say?"

"He's coming back with another doctor."

"This sure is strange isn't it. Me in this silly thing. What is it exactly? I can't make out what's on top of me."

"It's an ordinary apple crate."

"I'll be. I wonder how it happened to me."

"What did happen? Did you wake up that way?"

No. I got up early for breakfast, and I got dressed. Only I had a terrible headache and just laid down on the bed for a second when I fell back to sleep. I had a strange dream, I remember. I dreamed I was in school, in college, and I was a teacher teaching very intelligent men, not young kids. This one man asked me a question. I don't remember what it was, but I started to answer it on the blackboard when everything started spinning around and my head began to hurt and I woke up for just a second with this weird pain. Then I don't remember anything until much later, I think. Just before you came in, when I woke up again and everything was dark. I thought I was blind or something, but when I tried to get up this heavy thing was on my head. I felt it, and knew it was something wooden. I tried to speak but then I realized I could be heard from up here so I just laid back and waited. But I felt so funny. Not like I used to feel all the time. I felt younger and more relaxed. Like I did when I was a real young kid. I really don't want to get out of here, even though I am starved. I'd like to stay here all my life. I don't even have to think here. I just lie in the darkness and doze and then wake up again and feel my body moving inside, it moves slowly in rhythm. Do you think you could make a hole in the front, where my mouth is, so I could eat, Pa?"

The old man looked with disgust at his son. He could hardly believe what he heard. Make a hole in this thing so he could eat. He felt like getting a heavy hammer and smashing it to bits. He made no answer but sat on the edge of the narrow bed, his head in his hands.

"Pa. Can you hear me. Do you suppose you could just get a saw and make a hole right where my mouth is?"

Emil Prufnick could take no more and rose abruptly and left the room.

"Pa. Where are you? Are you getting the saw? Get the saw and make a hole right here, where my mouth is."

—Ruth Kahn

High Temperature Photos . . .

(Continued from Page 27)

be at different temperatures because of variations in the infrared radiations from the target. The oil will condense preferentially upon the cooler portions of the membrane. This variable condensation causes variation in the thickness of oil film which in turn changes the apparent color of each temperature-differential area of the membrane. Thus, the heat image focused on the membrane becomes visible and distinguishable through the different interference colors formed by the oil film. An oil slick on water exhibits the same colors.

The infrared optical system of the evaporograph is comparatively simple, consisting of a 4-inch-diameter, spherical, front-surface mirror with an 8-inch focal length, mounted to move along its axis to focus the image on the membrane. It is adjustable for distances from ten feet to infinity. A flat mirror in front of the sperical mirror is mounted at an angle of 45 degrees and serves to reflect the infrared image into the evaporograph cell.

The viewing optical system is equipped with a light source which illuminates the membrane uniformly and forms an image of the membrane both on photographic film and in an eyepiece for direct observation.

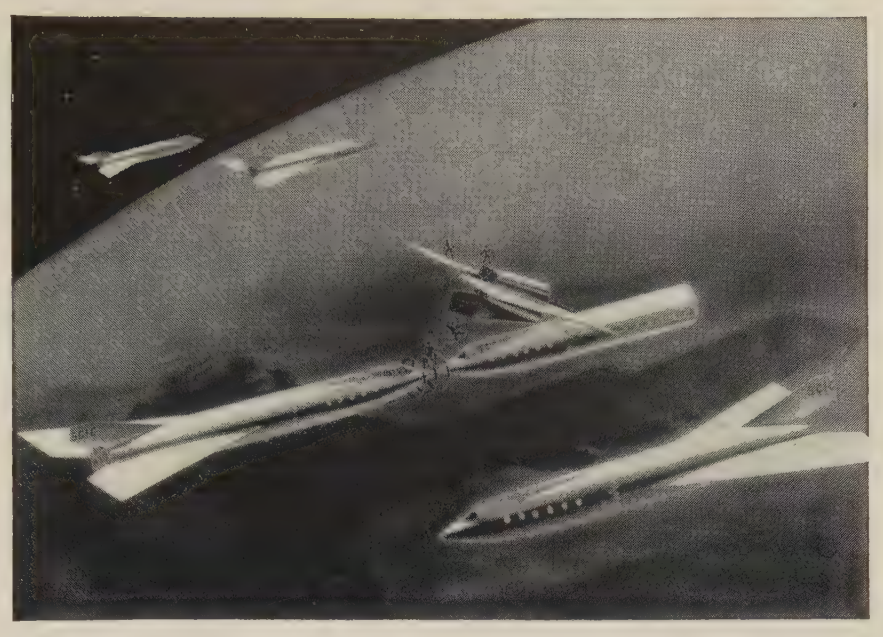
Light from the special bulb, which contains a spare filament, passes first through a piece of heat-absorbing glass and is then reflected by a mirror in a direction at a right angle to its original path. This light passes through a collimating lens which illuminates the membrane through a semi-transparent mirror.

The light is then reflected by the membrane to another mirror and passes down the viewing tube in a right-angle direction to the axis of the cell. Two lenses in this tube form an image of the membrane surface. A partially-reflecting mirror placed in the path of this light serves to split the beam into two parts. One beam forms an image on the film of a built-in 35-mm camera, the other forms a true image of the membrane in back of the mirror. This image is observed and photographed simultaneously.

By employing a reference temperature in the field of view, the evaporograph can be used to calculate unknown temperatures. By comparison of colors on the membrane, differences of temperature in the target area are readily seen.

Thus, the new device serves the duel purpose of making temperature differences visible and permitting temperature measurements to be made from the images produced.

MARS outstanding design **SERIES**



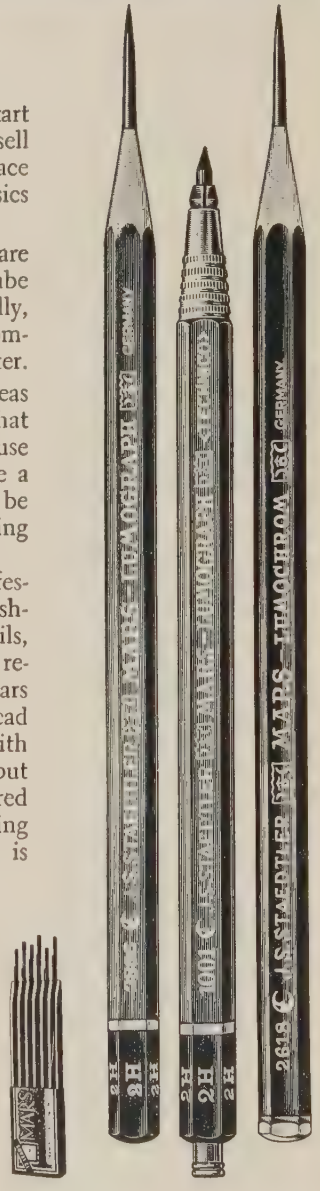
birth of a satellite

Most new ideas, like this inhabited satellite, start out as drawings on a sheet of paper. Here artist Russell Lehmann shows the first step in building the space station proposed by Darrell C. Romick, aerophysics engineer at Goodyear Aircraft.

Two ferry ships, one stripped of rocket units, are joined end to end. As others are added, this long tube forms temporary living quarters for crews. Eventually, outer shell will be built around core, making completed station 3,000 feet long, 1,500 feet in diameter.

No one can be sure which of today's bright ideas will become reality tomorrow. But it is certain that in the future, as today, it will be important to use the best of tools when pencil and paper translate a dream into a project. And then, as now, there will be no finer tool than Mars — from sketch to working drawing.

Mars has long been the standard of professionals. To the famous line of Mars-Technico push-button holders and leads, Mars-Lumograph pencils, and Tradition-Aquarell painting pencils, have recently been added these new products: the Mars Pocket-Technico for field use; the efficient Mars lead sharpener and "Draftsman's" Pencil Sharpener with the adjustable point-length feature; and — last but not least — the Mars-Lumochrom, the new colored *drafting* pencil which offers revolutionary drafting advantages. The fact that it blueprints perfectly is just one of its many important features.



The 2886 Mars-Lumograph drawing pencil, 19 degrees, EXEXB to 9H. The 1001 Mars-Technico push-button lead holder. 1904 Mars-Lumograph Imported leads, 18 degrees, EXB to 9H. Mars-Lumochrom colored *drafting* pencil, 24 colors.

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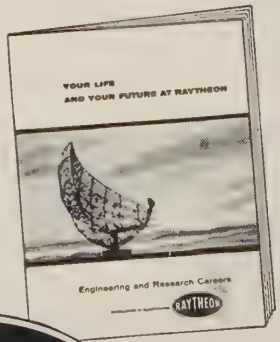

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JANUARY TECHNOCUTIE

Photos by Dave Moore

Technocutie . . .

The girl with the Greenwich Village sweater is Miss Dorothy Hanning, of Harrisburg, Illinois, this month's Technocutie. She is a sophomore in the School of Music, so for you who are interested in voice and piano, she's a real find.

A sparkling personality, she's interested in almost everything, especially if it's of an artistic nature. Participating in University Choir and Opera Workshop here on campus, she aims some day at a spot in grand opera. Classical music interests her too, but she's quite fond of jazz in the "cool school," and would like to learn more about it.

Outside the world of music, she studied for a time with the Ballet Russe de Monte Carlo, and still loves to dance. Also in the range of active sports, she likes all aquatic activities, especially swimming and waterskiing. After she leaves the University, Dorothy hopes to travel to Europe, particularly Switzerland and Italy, where she'd like to do some skiing. "I love the mountains," she admits, "and I'd even like to go prospecting."

Turning from the great outdoors, Dorothy claimed an interest in Sherlock Holmes, Ernest Hemmingway, Tennessee Williams, and Pablo Picasso, to round out an avid interest in the arts. Other than dramatic writers and impressionist painters she also likes good plays, concerts, sports cars, and pinochle. An interesting girl, and unattached, too.

For you mathematicians, Dorothy is 19 years old, and carries some 119 pounds on that 5′-6″ figure. She tops off those blue eyes with dark brown hair, and tapes 35-23-35 anyway you look at it. Give her a call at Evans Hall, for she isn't spoken for yet.

Know any cute girls?

. . . then tell us at Technograph!

SERIOUSLY, the Illinois Technograph is interested in obtaining nominations for the Technocutie of the Month. For many years we have been printing photos of girls who have won various queen contests on campus (or were among the finalists). We shall continue to print some of these pictures.

HOWEVER, and here is where you come in, we are interested in finding new talent. We are sure that there are many beautiful girls on campus who never appear in contests; you see them every day walking down the broadwalk. All we need to do is get names and phone numbers of these girls and we'll take care of the rest. Just fill in the blank and drop in any **University** mail box (not U. S. mail) or drop it off at 215 C. E. H. or the basement of Illini Hall (Daily Illini Office).

REWARDS are in it for you. For each girl selected, you will get a personally-autographed photo. Sound like a good deal? Then get busy!

Tear Here

ILLINOIS TECHNOGRAPH
215 Civil Engineering Hall

My nomination for Technocutie is_____

who lives at_____, phone_____

Her description is_____

_____

_____

I am_____and live at_____

_____

_____, phone_____

(Signed)_____

INDIANAPOLIS, IND.: (Special) It takes a lot of teamwork to carry out the missions of carrier-based fighter pilots of our New Air Navy. And, it takes a lot of teamwork to design, develop and produce a fighting machine for these dedicated men. Such teamwork is exemplified in the Allison J71 turbo-jet engine with afterburner (above) which powers the Navy F3H-2N Demon all-weather fighter-interceptor. Many Allison engineers--out of school only a few years ago and now well entrenched on the Allison Division team of General Motors Corporation--contributed to the operational success of this powerful engine. If you would like to know more about the Allison team, write Personnel Department, College Relations, Allison Division of General Motors Corporation, Indianapolis, Indiana

Old Vs. New

A. Elaborate Georgian architecture, so common in college towns, is expensive to construct and maintain.

In U. of I. Architecture

by Lowell Burgin

B. The simple, clean lines of contemporary architecture lend themselves to simplified, economical construction processes.

People who think the University of Illinois has a large campus now would be amazed to know about the large number of buildings now under construction or in the planning stage.

At the present time several new buildings are nearing completion. The Lincoln Avenue Residence Halls are now in the final stages of construction. The new band building was recently completed and is now in use. Construction of the biology building and an addition to the Illini Union are in the planning stage. The planning of these new buildings is a long procedure.

There are several individuals and committees responsible for the planning of a new building. First step in the construction of any new building on campus is the decision of the University building program committee that a certain department is most in need of a new building.

It is often a very difficult job for this committee to decide what building should be constructed first. The money acquired from the State Legislature for the University building fund must be used to the best advantage. Since every department of the University is in great need of expanded facilities, it is important to decide how the money should be spent.

After it is decided that a certain department needs a new building, an architectural firm is hired to design the structure. The building program committee,

Old vs. New In U. of I. Architecture

Photos by Dave Yates

C. Pouring the cement floor of new Men's Residence Hall additions.

D. A new, economical method of pouring concrete pillars into spiral cardboard forms which are discarded after the concrete hardens.

a committee from the department of architecture, and the University architect make suggestions to aid in designing the best structure. The last phase in the planning is preparation of the working drawings.

A building which is being designed for the U. of I. campus today will have a much different appearance than the older buildings. The style of architecture being used on the campus is rapidly changing. The old Georgian style of architecture is being abandoned as shown by the new Law Building.

The new style of architecture allows the use of less expensive building materials. The old Georgian style required a great deal of carving and decorative work on the outside of the building. The new trend in architecture, however, is to bring out the natural beauty of a building through better selection of building materials, such as glass, masonry, and wood.

It is now realized that the quadrangle arrangement of the campus has the disadvantage of not providing adequate parking space. The new buildings are therefore being built further away from the quadrangle. Thus the style of architecture on the U. of I. campus is being changed into a modern one.

Several new construction methods have been adopted for use on the new buildings. It has been found that building forms for a concrete floor are less expensive than using a pre-cast beam system. In the past, concrete floors were poured over a floor structure supported by concrete beams. This method is both expensive and inconvenient. The beams have to be specially made and much labor is involved in emplacing them.

When the new addition to L.A.R. and additions 3 and 4 of M.R.H. were constructed, the concrete floors were poured over forms with no beams or girders being used other than spandrel beams. It was found that building forms were less expensive than using pre-cast concrete beams.

No beams or girders will be used in the floors of the new women's residence hall to be built at Pennsylvania and Lincoln Avenues. The floors will be supported entirely by the partition walls beneath.

These are just a few of the ways in which the appearance of architecture on the campus is changing. Since the size of the campus is increasing rapidly and most new buildings are being built in the south end of campus, a tremendous growth of the campus in that direction is seen for the future. Many changes will come about in architecture on the U. of I. campus in the next few years, all with an eye toward better design and construction as well as economy.

Patent Laws and You

The legal complications of taking a patent are sometimes worth all the trouble. Here's how to find out what you need to know about . . .

by Raymond Norton

Do you want to shed your status as an amateur inventor and step into the ranks of those who hold patents? The procedure is somewhat difficult and not always justifiable, but it is of major importance if your invention meets certain qualifications.

First, keep in mind that only certain types of inventions are patentable. Only new and useful devices, machines, processes, articles of manufacture and improvements of previous patents can be filed for a new patent.

Now let's suppose that you have invented something patentable. The first thing to do is to make a rough sketch of your invention and write up a description of it as clearly as you can. A master copy with one carbon copy should be sufficient. Then call in a couple of your engineering friends or colleagues—people whom you think you can trust and who are capable of understanding your explanation of how the invention works. Tell them you are about to make a patent disclosure to them, and that you trust them not to disclose the information to anyone else. Then explain your invention to them and have them sign and date a statement, on the same sheet as the written description, that you have this day made a disclosure to them of the above-described invention. Sign and date the disclosure yourself, put your carbon copy in a safe place, and mail the original to yourself by registered mail. When the letter returns to you, do not open it but put it away in a safe place apart from the place where your carbon copy is located.

This may sound like a lot of red tape and a dangerous thing to do. It is, though, the only sure way to prove the date on which you conceived your invention in case of future lawsuits. It is actually relatively safe, since most people, strangely enough, are honest. They will not try to kidnap your brainchild. To do so would be a breach of trust, for which you could sue them.

After making your patent disclosure, do not rush to file a patent application. First, consider the following. Does your invention have engineering merit? That is, will your invention actually work and can it be reproduced in reasonable quantity? Second, does your invention

Patent Laws and You

have a reasonable sales potential? If it does not have reasonable sales potential in the form in which you originally conceived it, can that form be changed to give it a reasonable sales potential? If you have a pretty clear idea that the answers to these questions are favorable, the next step is to contact a reputable patent attorney and talk to him about the advisability of a preliminary patent search.

What is the purpose of such a search? A preliminary search may serve a number of purposes, but there are two in which you are interested just now. One, it will give you a reasonable idea as to whether or not your invention is really new. Another purpose served by a preliminary search is to acquaint you and your patent attorney with similar patented inventions. This information will enable the patent attorney, with your close cooperation, to draft a better patent application by more clearly distinguishing your invention from the so-called prior art. It is helpful to you, moreover, in that it may give you some ideas for either improving your invention or for redesigning it to better avoid the possibility of infringing upon somebody else's patent. Parenthetically, you may use a so-called "state-of-the-art" patent search as a tool. If you want to design something for a specific purpose, and if you're not sure of the latest developments in the field, you might have a patent search made and thereby save yourself considerable preliminary research. If someone else has already done part of the engineering work necessary to meet your requirements and embodied it in a patent, why not use his results as your departure point and work up from there?

Patent Claims

Let's assume now that on the basis of all these preliminary steps you decide to apply for a patent. You then request your patent lawyer to prepare an application for you. You do this, rather than drafting the application yourself, because the Patent Office has numerous technical requirements concerning the format and contents of the application with which the patent lawyer is more familiar. But, you can't simply turn the job over to him and forget about it. You must work with him to arrive at patent claims which will cover not only the "preferred embodiment" of your invention but also as many other "equivalent forms" as you can think of. One reason for this is that patent claims are narrowly construed by the courts. If you don't claim invention of all the equivalent forms of your device or process, a potential competitor can walk off with your market by selling at a lower price the equivalent form you didn't mention and nothing can be done about it.

Suppose that your patent application is finally filed and you receive notification of the filing or serial number from the Patent Office. What happens now?

Time for Action

If all does not go well, you might become involved in a controversy with the Patent Office over the allowability of some or all of the claims in your application. You might also become involved in a legal proceedings in the Patent Office known as an "interference." An interference arises when two applications are submitted about the same time conveying what the patent examiner regards as substantially the same invention. Since, under the Patent Act, a patent can be issued only to the inventor of a *new* process or device, it's up to the Patent Office (and sometimes the courts) to decide which of the two people first conceived the invention. This, of course, is the point at which your witnessed and dated patent disclosure (which you mailed to yourself) comes in handy as evidence of the date when you first conceived your invention.

On the other hand, if all goes well you will receive a patent in about two or three years. In the meantime, you can try to market your invention. If you are wise, and if you want to sell your patent rights outright, you will try to do so between the time you file your application and the time the patent is issued. One reason for this is that the purchaser might want to amend your application so that the resulting patent, when issued will conform to his own patent policies. It is naturally harder to persuade the Patent Office to reissue a patent in an amended form than to issue the original patent in the newly-desired form.

In connection with selling your patent rights, never, under any circumstances, sell a fractional interest in your patent rights. Sell either your entire interest, or none at all. You might be tempted to sell or mortgage a fractional interest to finance yourself or your application, or to capitalize early on the patent you expect, but patent laws permit a part owner of a patent to exploit the patent 100% without accounting to the other part owner for one cent.

Of course, there are other ways of exploiting your invention. One is to manufacture or use your invention yourself. Another, is to license others to manufacture, use, or sell it on payment of royalties. Unfortunately, both of these steps are frought with perils. Consult your patent lawyer before embarking in either of these directions.

Now let's suppose that your efforts have been successful and the postman delivers to your door a parchment that looks like a fancy diploma and is signed by the incumbent United States Commissioner of Patents. What do you have?

In answering this question I should like to shift both my emphasis and my viewpoint. Until now I've been discussing the mechanics of obtaining a patent, and I've aimed the discussion at the prospective individual inventor. But not all inventors fall into this category. At least, in their early professional careers, most engineers are employed by corporations of various sizes where they work in groups on new developments. And, frequently, one of the pre-conditions of their employment is that they sign over their potential patent rights relating to the company's business to their prospective employers. So now I'd like to discuss the meaning of patents from the employer's viewpoint and from the viewpoint of the potential engineering executive and businessman.

Legal Monopoly

In essence, a patent is a legally protected monopoly. The patent document itself intends to give to its owner the exclusive right, to make, use, and sell the invention described in the patent application, for a period of seventeen years. More accurately, it permits its owner to prevent anyone else from making, using, or selling the invention claimed.

Since a patent is a monopoly, and since our society has expressed itself through the antitrust laws, as opposed to monopoly in general, the granting of patents must somehow be justified. The classical justification is that a patent is granted as consideration for public disclosure which promotes the progress of science and the useful arts. In view of this justification, sound administration of the patent system requires that a patent be issued only when there has been a genuine invention which promises to lead to the development of science and the useful arts, that the invention

". . . patent laws permit a part owner of a patent to exploit the patent 100% without accounting to the other part owner for one cent."

be fully disclosed to the public through the patent application, and that the patent monopoly cease at the expiration of the statutory period of seventeen years.

Now, there have been a number of serious obstacles to sound administration of the patent system. One is that there have been no exact standards of what constitutes genuine invention. Congress has laid down no infallible test, and the courts use conflicting standards. Consequently gadgetry sometimes succeeds where basic work fails. A new combination of circuits in a pinball machine has been held to constitute an invention, but Marconi's work was held to be insufficiently above the level of the prior art to make him the inventor of the wireless.

Other Obstacles

Another major obstacle in the sound administration of the patent system is that the Patent Office is not equipped to apply even such vague standards as there are. Not only is the number of examiners inadequate to permit careful scrutiny of the tremendous flow of applications, but also the examiners are hampered because of their lack of laboratories and proving grounds. Moreover, the examiners can't keep abreast of the court decisions. As a result of this, many patents are issued which could not stand up in court. It has been estimated that the average patent has only one chance in ten of being upheld if fully tested in court. This doesn't mean that the other fellow's patent can be ignored. Lawsuits are expensive. Small manufacturers frequently yield to the mere threat of a patent infringement suit, even when convinced of the validity of the patent.

A third obstacle to sound administration is that the exclusive right may be extended beyond the statutory limit of 17 years by accident or design. An application may lie dormant in the Patent Office for some time before the patent is issued. Mistakes may be made in the application and then corrected. Improvements, and then improvement on improvement, may be patented. One company, whose business was built on about a dozen basic or "pioneer" patents, accumulated more than 9,000 secondary patents and obtained rights under 6,000 others. This company used these patents to eliminate its competitors long after its original basic patents had expired.

"Too Many Fingers"

As a particularly good illustration of how patents are sometimes used, I should like to relate certain facts which were brought out in a fairly recent criminal antitrust case. This case resulted in conviction of all defendants and the imposition of relatively small fines.

In the early 1920's some ingenious Americans began to make and market cutting tools made from an alloy of a new material which greatly increased the hardness of steel. By 1928 a foreign manufacturer was marketing this material in the United States at a price of $48 per pound. About the same time a large American company was experimenting in the making of tools of this new material, and it naturally assigned one of its patent lawyers to study the patents owned by the foreign manufacturer. It was his opinion that these patents were worthless. Some of the executives of the American company were informed of this opinion and believed these patents worthless. Nevertheless, when approached by officials of the foreign manufacturer, the American company entered into an agreement with the foreign company for the pooling of patents, with the hope, as expressed in one of the home-bound reports of a representative of the foreign company, that it would "succeed in delaying unauthorized competition." The American company then established a subsidiary to make and market the new steel hardener. Shortly afterward the subsidiary raised the price of this material from the original $48 per pound to $453 per pound or $1 per gram. American industry was naturally slow to use the material at this price.

Having exchanged patent rights with the foreign company, and having obtained the right to grant licenses in the United States under the foreign patents, the American company's subsidiary began to license other manufacturers of the new material. In each case these licenses required the licensee, who was a competitor of the subsidiary, to grant back a license to the subsidiary under any patent the licensee possessed or might later acquire in the field. Thus, the subsidiary acquired rights under almost all the patents in the industry.

Sometimes it was necessary to start infringement suits to bring competitors into line. The subsidiary started nine such suits and threatened others in the period from 1928 to 1940. But always, except in one case, the subsidiary sidestepped a judicial determination of the validity of the basic patents. Except for one case, the subsidiary obtained out-of-court settlements in which the so-called "infringers" were forced to accept either license or agency agreements from the subsidiary. The agreement made them unwilling partners to an arrangement under which the subsidiary fixed prices not only on its patented tools but also on unpatented tools as well.

The one case in which the subsidiary failed was that of a small tool-and-die maker in Detroit. When he refused to maintain prices, the subsidiary sued him for patent infringement. Unfortunately for the subsidiary, the Detroit toolmaker was a very stubborn man. He fought the suit to the bitter end, refusing to accept any out-of-court settlement. The court in 1941 declared the patents invalid. The Detroit toolmaker, incidentally, had been forced to spend $75,000 in his defense. It is interesting to note that a similar defense today would cost about three times as much because of inflation since 1941.

2000 Abuses

In conclusion it might be pointed out that, while not all companies engage in similar practices, the case described is not unique. The Antitrust Division of the Department of Justice has brought approximately 2000 cases in its history. Many of these involving patent abuses, have been brought about successfully. Moreover, it is well known that the Antitrust Division, because of limited resources, is forced to limit itself to taking action in only a small percentage of cases where violations are known to exist. The patent grant, therefore, while conceived as an incentive to invention, achieves additional importance in the business world as a handy weapon, both for legal and illegal reduction of competition and for self-defense against the more predatory use of other patents.

Tranquilizers Mean Business

The total number of prescriptions dispensed by domestic retail druggists last year came to 629 million—nine per cent more than 1955's 577 million, reports *Chemical Week*. More than half the total increase can be attributed to sales of tranquilizers and hormones, with gains also scored by blood-pressure drugs.

Engineering Madness

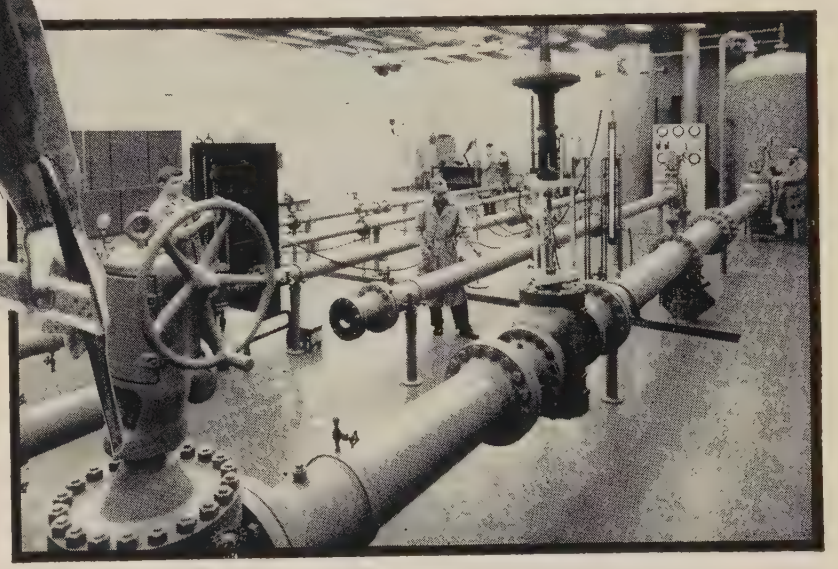
The designer sat at his drafting board;
A wealth of knowledge in his head was stored;
Like "What can be done on a radial drill,
Or a turret lathe or a vertical mill?"
But above all things, a knack he had
Of driving gentle machinists mad.
So he mused as he thoughtfully scratched his bean
"Just how can I make this thing hard to machine?"
If he made this body perfectly straight,
The job had ought to come out first-rate.
But 'twould be so easy to turn and bore
That it would never make a machinist sore.
So he'll put a compound taper there,
And a couple of angles to make 'em swear,
And brass would work for these little gears,
But it's too damned easy to work, he fears,
So just to make the machinist squeal,
He'll make him mill it from tungsten steel!
He'll put those holes that hold the cap
Down underneath where they can't be tapped.
Now if they can make this it'll be just luck,
'Cause it can't be planed and can't be ground,
So he feels his design is unusually sound,
And he shouts in glee, "Success at last!
This damned thing can't even be cast!"

—from the Nebraska Blue Print

Ambitious young engineers

thrive in this ideal "growing" environment

WORLD'S LARGEST RESEARCH CENTER FOR AUTOMATIC PRESSURE AND LIQUID LEVEL CONTROL



Modern research laboratory at Fisher includes high and low pressure flow lines in sizes up to 12 inches

During the past three quarters of a century, the Fisher research and development departments have produced some of the outstanding developments in control instrumentation and automation.

At the same time, these laboratories have developed some of the nation's leading control engineers! The two go together at Fisher.

If you are looking for challenge, opportunity and a future that will touch practically every basic industry in the world, consult your placement office or write us about the opportunities Fisher holds in store for you.

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD...CHANCES ARE IT'S CONTROLLED BY

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SINCE 1880

Brainteaser Answers

(Continued from Page 33)

1. Jd Ac Qs Kh
   Ks Qh Ad Jc
   Ah Js Kc Qd
   Qc Kd Jh As

2. There were 10 boys in the school.

3. The engineer of the train was named Smith.

4. The monkey was holding a banana which was exactly 7.67 inches long.

5. SLAP 7326 SIAP 7326
   +DEP 859 −DEB −859
   DUDE 8185 PIPS 6467

6. By similar triangles and the Pythagorean theorem it may be easily shown that
   OMSK to MINSK—10 Miles
   OMSK to MUNSK—10 Miles

7.
```
          2827
      ------------
128 ) 361856
        256
      ------
        1058
        1024
      ------
         345
         256
      ------
         896
         896
      ------
```

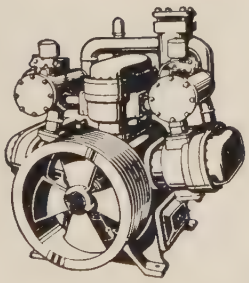
8. He goes 7.7 miles.

Healthy Diets

Food sales through chain stores will increase 6.7 per cent in 1957, reports *Food Engineering*. Supermarkets now handling 7,500 items will have doubled this figure by 1961. Food stores declined from 3487,000 in 1939 to 279,000 in 1954—but sales per store have nearly tripled.

FRICK TRADE MARK Refrigeration

THE NAME BACKED BY



FRICK REFRIGERATING MACHINES BUILT IN OVER 80 TYPES and SIZES

104 YEARS OF ENGINEERING
•
75 YEARS OF REFRIGERATION
•
50 YEARS OF AIR CONDITIONING

WRITE FOR INFORMATION ON AIR CONDITIONING-REFRIGERATION ENGINEER TRAINING COURSE

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA., U. S. A.

Why Vought Projects Bring Out The Best In An Engineer

At Vought, the engineer doesn't often forget past assignments. Like all big events, they leave vivid memories. And it's no wonder.

For here the engineer contributes to history-making projects — among them the record-breaking Crusader fighter; the Regulus II missile, chosen to arm our newest nuclear subs; and the new fast-developing 1,500-plus-mph fighter, details of which are still classified.

The Vought engineer watches such weapons take shape. He supervises critical tests, and he introduces the weapons to the men with whom they will serve.

Engineers with many specialties share these experiences. Today, for example, Vought is at work on important projects involving:

electronics design and manufacture
inertial navigation
investigation of advanced propulsion methods
Mach 5 configurations

Vought's excellent R&D facilities help the engineer through unexplored areas. And by teaming up with other specialists against mutual challenges, the Vought engineer learns new fields while advancing in his own.

★★★

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Dept. CM-4

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

A Vought Vignette
ONE OF A SERIES

The Aircraft Designer Who Went to Sea...

IT WAS A ROUTINE CRUISE for the *Bon Homme Richard.* But for Wayne Burch, it was a memorable climax to months of hard work. Aboard the carrier with the Chance Vought design specialist was the white-lacquered fighter he'd worked on so long.

★

Wayne had joined the Crusader dayfighter project in Preliminary Design, on alighting and arresting gear. He'd transposed his initial drawings into detail design and, later, he'd watched his gear pass jig and aircraft drop tests. At the Navy Test Center, the Crusader's gear absorbed maximum sink speeds and arresting tension, and Burch once more was there.

★

Now, Navy pilots on the *Bon Homme Richard* were taking the Crusader to sea, and Burch was going along. This time his assignment was simply to watch, and this time the Crusader was to be just part of the picture. Vought wanted him to experience carrier life and to see how his new weapon fitted in. For Wayne, whose sea log began and ended with one day's fishing from a 20-foot launch, it promised to be an eye-opening voyage.

For six days the designer shared quarters with Navy fighter pilots and had coffee with maintenance men. He studied aircraft spotting and catapulting, and he learned the sign language of the LSO (Landing Signal Officer). He marveled at the fingersnap timing of the Navy's deck handlers and at the *Bon Homme Richard's* mid-voyage refueling of two bobbing destroyers.

★

Wayne calls it "one of the most enjoyable weeks of my life" . . . and, as other sea-going Vought engineers have discovered, "one of the most profitable, too.

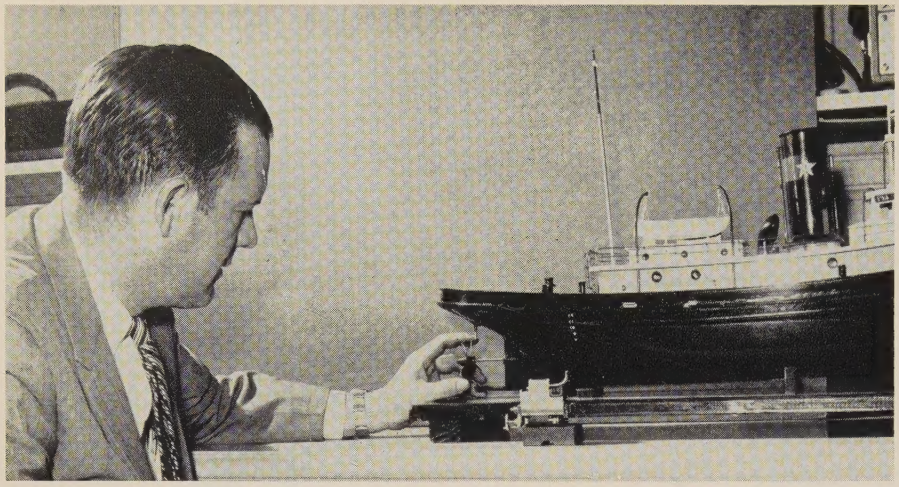
"Now I know the pilot's job, what maintenance wants . . . how really big the operation is.

"It's something you don't get if you stick too close to design.

"I guess you'd call it *perspective.*"

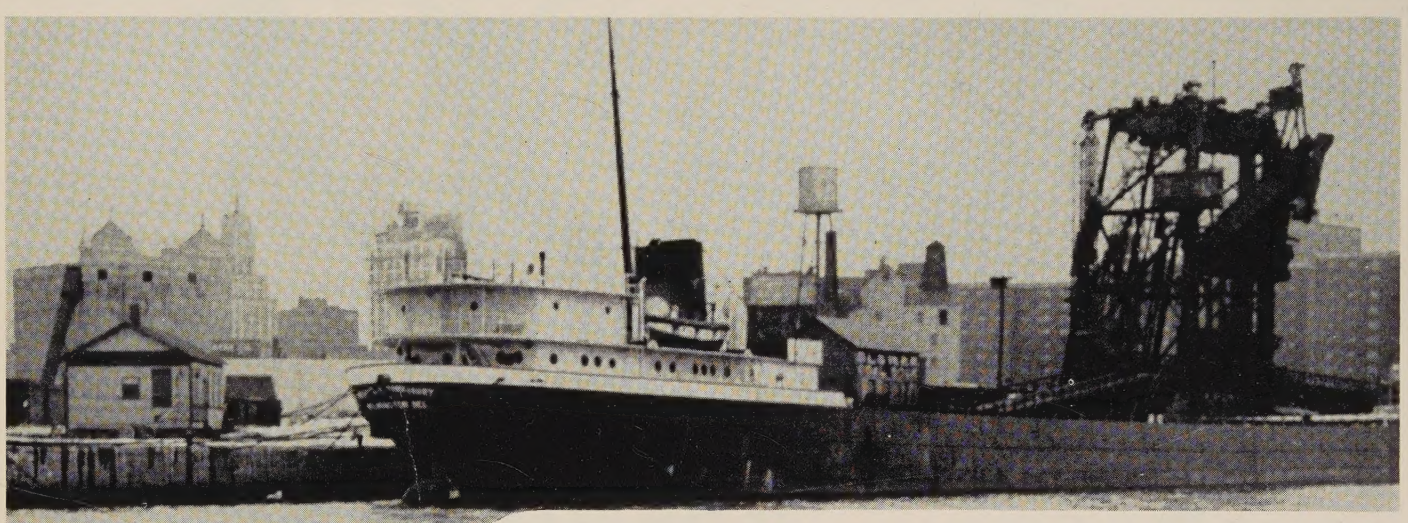
At Chance Vought the designer stays in touch with his product . . . Contact begins in development, extends through test and includes, when possible, a study by the designer of the tactical environment in which his weapon will serve.

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS



This 'Boneyard" sized tugobat is only 34 inches long

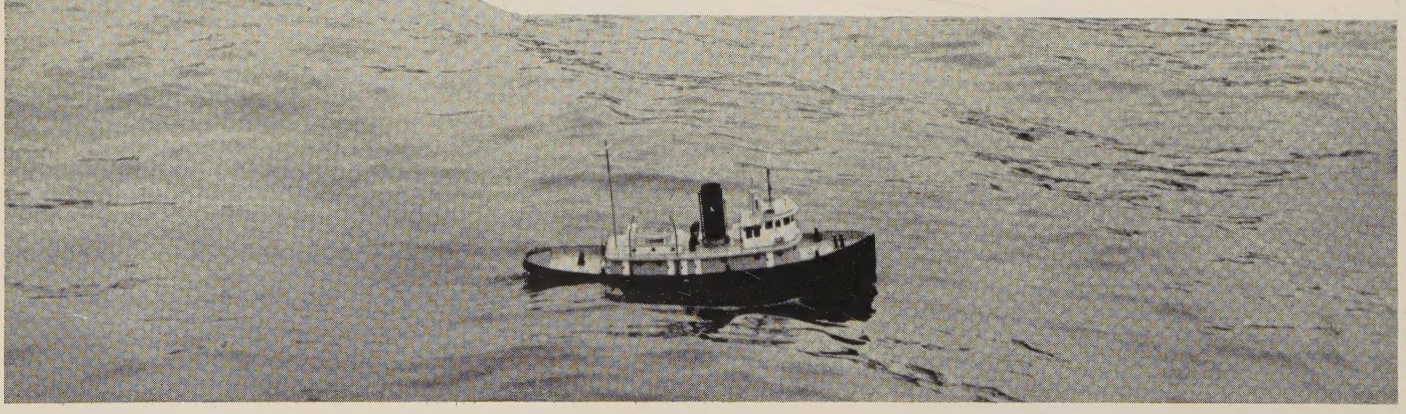
Tiniest Tugboat

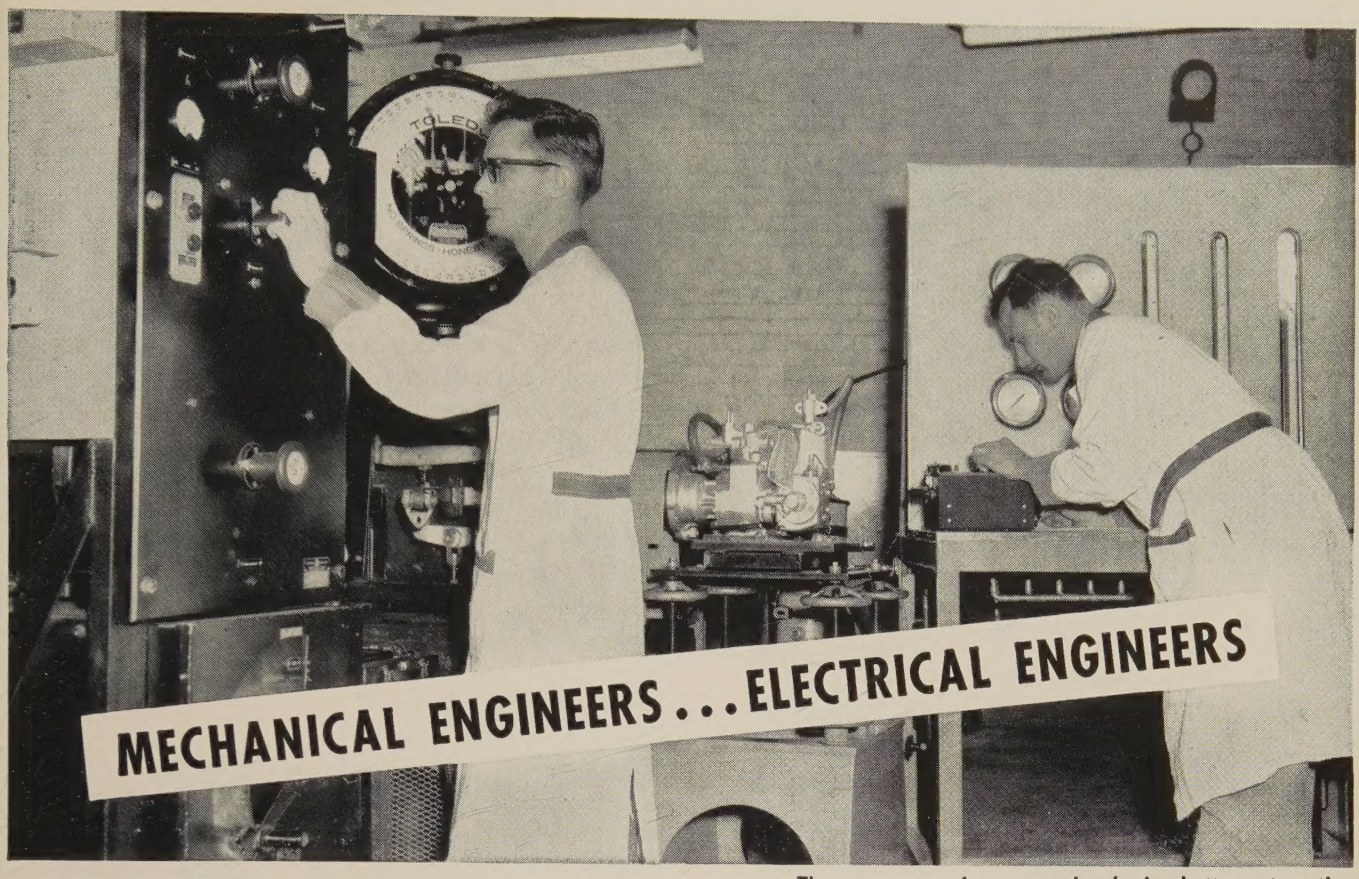


Engineering talent and modern construction draw no limits in their application, as proven by the "Polaris." This 34 inch radio control tugboat, built by Harry H. Larkin of Buffalo, New York, has all the maintenance problems of the full size article and a few more of its own because of its unusual size, but ingenuity solves them,

Corrosion, erosion, and metal fatigue are especially critical because of the small size of the parts. When the original steel propeller shaft gave way, Mr. Larkin replaced it with one made of "R" monel, which is extremely corrosion-resistant.

Performance was so good that the reduction gearbox has since been replaced with the same material. Mr. Larkin used a common solution to the corrosion problem, and now boasts the smallest monel propeller.





These young engineers are developing better automotive brakes in Wagner's Automotive Research Laboratory.

Grow with a growing company!

Wagner Electric Corporation serves 2 great growth industries — AUTOMOTIVE — ELECTRICAL

If you want to grow with a company that is consistently growing in two great industries, take a look at the opportunities you can find with the Wagner Electric Corporation. Wagner is St. Louis' largest manufacturer of products for the automotive and electrical industries. Established in 1891, Wagner has a history of doubling its volume of business every eight to ten years. Today Wagner ranks among the 350 largest industrial companies in the country—a well established company offering real opportunity.

Here are some of the advantages you can find at Wagner:

- Advancement from within. The management team today is composed of many men who started with Wagner as junior engineers.
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Begged, Borrowed, and . . .

SEX AND THE ILLINOIS ENGINEER

two worlds apart, far far apart
  two spheres which never merge
sex and the Illinois engineer
  are scopes which cannot converge
the first stays in Evans hall
  flashing eyes and swaying hips
the fishbowl sees them all
  tight-fitting sweaters and red-red lips
the second lives beneath the arch
  his slide rule by his side
and daily off to bluebooks march
  to live unloved until he died

a million miles is the diag's length
  and the hill is further still
when homework assignments stay his
    strength
  and finals break his will
two worlds apart, far far apart
  two spheres which never merge
sex and the Illinois engineer
  are scopes which cannot converge

Adapted from The Michigan Engineer

* * *

Getting out a joke column is fun, but it's no picnic.

If we don't print jokes, we are too serious.

If we do print jokes, we are silly.

If we take them from other magazines, we are too lazy to write them ourselves.

If we don't print contributions, we don't appreciate true genius.

If we do print them, the pages are full of junk.

And now, like as not, someone will say we stole this from some other magazine.

We did.

* * *

Four and twenty test tubes,
A beaker full of lime,
Eight students a-yawning
Asleep for most the time;
When the tubes are opened,
Fumes begin to reek,
Isn't that an awful mess
To have three times a week.

The farmer had been to the big city on business for a couple of weeks. Getting off the train at his home town, he happened to run into his hired hand.

"Hi Zeb!" What's new?"

"Not much."

"That's fine, boy did I . . ."

"'Ceptin' we buried your dog."

"You buried my dog? Why?"

"'S daid."

"I figured it was if you buried it. How'd it die?"

"Hoss kicked it."

"Why'd the horse kick it?"

"Spark fell on it."

"Spark- Where did the spark come from?"

"From the barn."

"From the barn? What happened to the barn?"

"Burned down."

"How'd the barn catch fire?"

"S'pose it was sparks from the house."

"You mean the house burned too?"

"Yep!"

"How'd that start?"

"Figure the candles caught the drapes."

Candles? What candles?"

"The ones around yer wife's coffin."

* * *

Ginger ale: a drink that tastes like your foot feels when it's gone to sleep.

Golddigger: A girl who breaks dates by going out with them.

Alcoholic rheumatism: Getting stiff in every joint.

Mixed company: What you are in when you think of a story you can't tell.

* * *

The wild crowd has a new game going. Three guys rent a hotel room and each brings a quart of Old Screech with him. They sit and drink for an hour, then one of them gets up and leaves. The other two have to guess which one left.

* * *

Notice to the Milk Depot:

We are a little short of milk just now . . . some of our best cows are out having a bull session.